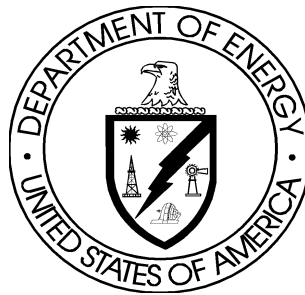


**DOE Regulatory Unit Evaluation  
of the BNFL Inc.  
Safety Requirements Document, Revision 1A**



December 2, 1998

Office of Radiological, Nuclear, and Process  
Safety Regulation of TWRS Privatization Contractors

Richland Operations Office  
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Approved: \_\_\_\_\_

Date: \_\_\_\_\_

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## PREFACE

The Department of Energy's (DOE) Richland Operations Office (RL) issued the *TWRS Privatization Request for Proposal* (RFP) for Hanford Tank Waste Remediation System (TWRS) Privatization in February 1996. Offerors were requested to submit proposals for the initial processing of the tank waste at Hanford. Some of this radioactive waste has been stored in large underground storage tanks at the Hanford Site since 1944. Currently, approximately 56 million gallons of waste containing approximately 240,000 metric tons of processed chemicals and 250 mega-curies of radionuclides are being stored in 177 tanks. These caustic wastes are in the form of liquids, slurries, saltcakes, and sludges. The wastes stored in the tanks are defined as high-level radioactive waste (10 CFR Part 50, Appendix F) and hazardous waste (Resource Conservation and Recovery Act).

Under the privatization concept, DOE will purchase waste treatment services from a contractor-owned, contractor-operated facility under a fixed-price contract. DOE will provide the waste feedstock to be processed but maintain ownership of the waste. The contractor must: a) provide private financing; b) design the equipment and facility; c) apply for and receive required permits and licenses; d) construct the facility and bring it on-line; e) operate the facility to treat the waste according to DOE specifications; and f) deactivate the facility.

The TWRS Privatization Program is divided into two phases, Phase I and Phase II. Phase I is a proof-of-concept/commercial demonstration-scale effort the objectives of which are to a) demonstrate the technical and business viability of using privatized contractors to treat Hanford tank waste; b) define and maintain adequate levels of radiological, nuclear, process, and occupational safety; c) maintain environmental protection and compliance; and d) substantially reduce life-cycle costs and time required to treat the tank waste. The Phase I effort consists of two parts: Part A and Part B.

Part A consists of a twenty-month development period to establish appropriate and necessary technical, operational, regulatory, business, and financial elements. This will include identification by the TWRS Privatization Contractors and approval by DOE of appropriate safety standards, formulation by the Contractors and approval by DOE of integrated safety management plans, and preparation by the Contractors and evaluation by DOE of initial safety assessments. Of the twenty-month period, sixteen months will be used by the Contractors to develop the Part-A products and four months will be used by DOE to evaluate the products.

Part B consists of a demonstration period to provide tank waste treatment services by one or more of the TWRS Privatization Contractors who successfully complete Part A. Demonstration will address a range of wastes representative of those in the Hanford tanks. Part B will be 10 to 14 years in duration. Within Part B, wastes will be processed during a 5- to 9-year period and will result in treatment of 6 to 13 percent of the Hanford tank waste.

Phase II will be a full-scale production phase in which the remaining tank waste will be processed on a schedule that will accomplish removal from all single-shelled tanks by the year 2018. The objectives of Phase II are to a) implement the lessons learned from Phase I; and b) process all tank waste into forms suitable for final disposal.

A key element of the TWRS Privatization Contracts is DOE regulation of radiological, nuclear, and process safety through the establishment of a specifically chartered, dedicated Regulatory Unit (RU) at RL. This regulation by the RU is authorized by the document entitled *Policy for Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors* (referred to

as the Policy) and implemented through the document entitled *Memorandum of Agreement for the Execution of Radiological, Nuclear, and Process Safety Regulation of the TWRS Privatization Contractors* (referred to as the MOA). The Policy is signed by the Under Secretary of Energy; the Manager, RL; the Assistant Secretary for Environment, Safety and Health (ASEH); and the Assistant Secretary for Environmental Management (ASEM). The MOA is signed by the Manager, RL; the ASEH; and the ASEM. The nature and characteristics of this regulation are also specified in these documents. The MOA details certain interactions among RL, the ASEH, and the ASEM as well as their respective roles and responsibilities for implementation of this regulation.

The authority of the RU to regulate the TWRS Privatization Contractors is derived solely from the terms of the TWRS Privatization Contracts. Its authority to regulate the Contractors on behalf of DOE is derived from the Policy. The nature and scope of this special regulation (in the sense that it is based on terms of a contract rather than formal regulations) is delineated in the MOA, the TWRS Privatization Contracts, and the four documents (listed below), which are incorporated into the Contracts. This special regulation by the RU in no way replaces any legally established external regulatory authority to regulate in accordance with their duly promulgated regulations nor relieves the Contractors from any obligations to comply with such regulations or to be subject to the enforcement practices contained therein.

The Policy, the MOA, the TWRS Privatization Contracts, and the four documents incorporated in the Contracts define the essential elements of the regulatory program, which will be executed by the RU and to which the TWRS Privatization Contractors must conform. The four documents incorporated in the Contracts (and also incorporated in the MOA) are

*Concept of the DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, DOE/RL-96-0005,

*DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, DOE/RL-96-0003,

*Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006, and

*Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*, DOE/RL-96-0004.

In the execution of the regulatory program, the RU will consider not only the relevant approaches and practices of DOE but also those of the Nuclear Regulatory Commission (NRC). The Policy states that

"It is DOE's policy that TWRS privatized contractor activities be regulated in a manner that assures adequate radiological, nuclear, and process safety by application of regulatory concepts and principles consistent with those of the Nuclear Regulatory Commission."

To this end, the RU will interact with the NRC (under the provisions of a memorandum of understanding with the NRC) during development of regulatory guidance and during execution of the regulatory program to ensure implementation of this policy.

**All documents issued by the Office of Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors are available to the public through the DOE/RL Public Reading Room at the Washington State University, Tri-Cities Campus, 100 Sprout Road, Richland, Washington.**

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## EXECUTIVE SUMMARY

On November 6, 1998, BNFL submitted the BNFL Safety Requirements Document, Revision 1A in response to the issues identified by the Regulatory Unit in its evaluation (RL/REG-98-20, Revision 0) of the BNFL Safety Requirements Document, Revision 1. Appendix A of this evaluation report (RL/REG-98-20, Revision 1) documents the RU evaluation of changes made by BNFL in BNFL Safety Requirements Document, Revision 1A. The Regulatory Unit's evaluation of BNFL Safety Requirements Document, Revision 1 is provided so that the reader can refer to the issues as originally cited. The Regulatory Unit reviewers assessed SRD Revision 1A changes, using *Guidance for the Review of TWRS Privatization Contractor Safety Requirements Document Submittal Package (RL/REG-97-08)*.

In BNFL Safety Requirements Document, Revision 1A, BNFL proposed changes to address the open conditions of approval for preliminary design. (The Regulatory Unit evaluation did not assess the conditions of approval that must be met prior to authorization of construction.) In addition, BNFL proposed changes to address RU reviewer questions during the review of BNFL Inc. SRD Revision 1. BNFL also proposed changes to correct two recurring problems, application of the *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization* (DOE/RL-96-0004) to establish subordinate standards, and document control of regulatory submittals.

The RU reviewers concluded that changes in the SRD, Revision 1A resolved all the conditions for approval except one and the changes made in response to reviewer questions were adequate except one. The exceptions are the subordinate standards that BNFL provided for defense in depth were not adequately tailored in that the standards used some undefined generic power reactor terms rather than facility or Contract specific terms and the subordinate standards that BNFL provided for environmental radiation protection were incomplete because these standards did not adequately implement the Safety Criteria 5.3 and 5.4. On November 25, BNFL provided a revised set of implementing standards for environmental radiation protection that the Regulatory Unit is currently evaluating.

Based on this evaluation, the BNFL Inc. SRD Revision 1A is conditionally approved and effective the date of this letter is part of the Authorization Basis. BNFL is authorized to start preliminary design activities subject to the following two conditions:

- 1) BNFL may use the defense in depth implementing standards of SRD Revision 1A, Appendix B, to conduct preliminary design until December 16, 1998, only to the extent that there is no ambiguity in the application of the consensus standards referenced in the implementing standards. If the planned December 2, 1998, BNFL submittal of tailored consensus standards for defense in depth is not acceptable to the RU, this conditional approval will be revoked no later than December 16, 1998. If this conditional approval is

revoked, affected design work may not proceed further until the RU approves an acceptable revision of the implementing standards.

2) BNFL may start preliminary design activities of structures, systems or components except for those associated with effluent and environmental monitoring (including sources of airborne emissions, sources of discharge in liquid waste streams and effluent monitoring), and ground water protection until the RU approves implementing standards for these activities. This conditional approval will be revoked after February 2, 1998, if the RU has not approved an acceptable set of implementing standards for SRD Safety Criteria 5.3 and 5.4.

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## 1.0 INTRODUCTION

On November 6, 1998, BNFL submitted the BNFL Safety Requirements Document, Revision 1A in response to the issues identified by the Regulatory Unit in its evaluation (RL/REG-98-20, Revision 0) of the BNFL Safety Requirements Document, Revision 1. Appendix A of this evaluation report (RL/REG-98-20, Revision 1) documents the RU evaluation of the changes made by BNFL in BNFL Safety Requirements Document, Revision 1A. The Regulatory Unit's evaluation of BNFL Safety Requirements Document, Revision 1, Sections 2 through 4, is provided so that the reader can refer to the issues as originally cited. Undisclosed changes were not reviewed (see Configuration Control) and the RU makes no statement of approval or disapproval of such changes. The Regulatory Unit reviewers assessed SRD Revision 1A changes, using *Guidance for the Review of TWRS Privatization Contractor Safety Requirements Document Submittal Package* (RL/REG-97-08).

In BNFL Safety Requirements Document, Revision 1A, BNFL proposed changes to address the open conditions of approval for preliminary design. The Regulatory Unit evaluation did not assess the conditions of approval that must be met prior to authorization of construction. In addition, BNFL proposed changes to address commitments made in response to Regulatory Unit reviewer questions during the review of SRD Revision 0.<sup>1</sup> BNFL also proposed changes to correct two recurring problems, application of the *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization* (DOE/RL-96-0004) to establish subordinate standards,<sup>2</sup> and document control of regulatory submittals.

## 2.0 RECURRING PROBLEMS WITH BNFL REGULATORY SUBMITTALS

The evaluation determined that BNFL has not corrected two recurring problems with their regulatory submittals, application of the *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization* (DOE/RL-96-0004) to establish subordinate safety standards and configuration control.

### 2.1 SUBORDINATE SAFETY STANDARDS

Establishment of subordinate standards is not consistently in accordance with the Contract and remains a regulatory concern. DOE/RL-96-0004, *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*, Revision 0, describes the process for determining the safety standards required by the contract. In SRD

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<sup>1</sup> RL/REG-98-01, Revision 0, March 1998.

<sup>2</sup> DOE/RL-96-0005 states: "DOE requires that the Contractor follow a DOE-specified, structured process to identify the set of subordinate standards and requirements that, when properly implemented, provide adequate safety, comply with legal requirements, and conform to the top-level safety standards and principles." Throughout this document these "subordinate standards and requirements" are referred to as "subordinate standards."

Revision 0, BNFL established safety criteria that represented standards related to the Top-Level Principles<sup>3</sup> of DOE/RL-96-0006, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*. Most of the safety criteria conformed to the Top-Level Principles because they either repeated the Top-Level Principles or provided some additional detail not explicit in the Principles. However, RU review of SRD Revision 0 found that many of the safety criteria did not identify standards subordinate to the safety criteria (subordinate standards) as required by the *Concept of the DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors* (DOE/RL-96-0005). Additionally, it appeared that some of the subordinate standards that BNFL had established had not been derived from the process required by DOE/RL-96-0004.

To correct these deficiencies, BNFL added subordinate standards (implementing codes and standards per BNFL terminology) to the safety criteria in SRD Revision 1. The RU reviewers found that many of the subordinate standards in SRD Revision 1 are *ad hoc*; not industry consensus standards, but standards developed by BNFL. Generally, these ad hoc standards are referenced in SRD Revision 1 and are contained in the text of the Integrated Safety Management Plan (ISMP). This method of presentation resulted in the following issues. First, the reviewers could not identify the specific subordinate standard because BNFL chose to reference only the section of the ISMP containing the subordinate standard in SRD Revision 1 and did not identify the specific text that cited the standard. The content and relevance of the specified ISMP sections varies considerably. Second, in the ISMP Revision 3, BNFL did not provide a clear basis for selection of the subordinate standard. The ISMP provides detailed descriptions of the various methods or techniques by which BNFL commits to *manage* conformance with the Top-Level Principles; however, the reviewers could not determine for what work, hazard(s), and control strategies the standard was established. Third, in some instances, the RU reviewers found several cases where referenced sections of the ISMP are not relevant to the Safety Criterion.

The RU remains concerned that BNFL has not consistently implemented the standards process required by the contract. BNFL is required to select standards based on work, hazards and control strategies associated with BNFL proposed processes. Specifically, DOE/RL-96-0004 requires the development and identification of accident sequences, including initiating events, such that appropriate means to prevent or mitigate the consequences of the postulated events can be determined. DOE requires the Contractor to follow a structured process to identify the set of subordinate standards.<sup>4</sup> All of the elements in each of the Top-Level Principles must flow down through the safety criteria to the subordinate standards; otherwise, essential concerns in the Top-Level Principles may not be adequately implemented during design, construction, operation, and decommissioning. All parts of the Top-Level Principles must be addressed in the Contractor's set of subordinate standards. Tailoring of the standards for the control of hazards occurs in the necessary and sufficient application of the subordinate standards to achieve adequate safety.

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<sup>3</sup> DOE/RL-96-006 states: "This document provides a set of top-level radiological, nuclear, and process safety standards and principles prescribed by the U. S. Department of Energy (DOE) for accomplishing the expected level of safety for TWRS Privatization."

<sup>4</sup> "Concept of the DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors, DOE/RL-96-0005, September 1996.

BNFL must, prior to proceeding with preliminary design, correct the deficiencies associated with subordinate standards required for preliminary design.<sup>5</sup>

## 2.2 CONFIGURATION CONTROL

Control of the configuration for regulatory submittals that are part of the Authorization Basis is inconsistent and must be corrected prior to preliminary design. The following are three examples of inadequate configuration control found during the review of SRD Revision 1 and ISMP Revision 3.

### Example 1

Section 1.3.7 of ISMP Revision 3 states:

“If credit is taken for operator action to satisfy the public radiological exposure standards of Table 1-2, adequate radiation protection is provided to permit access and occupancy of the control room or other control locations under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body gamma and 30 rem beta skin for the duration of the accident.”

This statement is not found<sup>6</sup> in ISMP Revision 0 and justification was not provided for it as part of the ISMP Revision 3 submittal. RU reviewers did find that the above radiation standard is found in a safety criteria of the SRD.

### Example 2

ISMP Revision 3, Section 10.4 (a new section), in which the second paragraph of Section 10.4.1 states in part:

“Consistent with the nature of the fixed-priced contract, the RU inspection program is executed in a planned, disciplined, and predictable manner that includes a defined limit on the number of inspectors per visit and the number of inspections per year.” (Emphasis added).

Justification was not provided for adding the phrases shown in underline, giving rise to addition of a new issue found to be unacceptable in the review of ISMP Revision 3.

### Example 3

In SRD Revision 1, BNFL incorporated numerous changes to Table 2-1, “Radiological Exposure

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<sup>5</sup> The RU authority and content requirements for approving the contractor’s recommended set of subordinate standards is contained in DOE/RL-96-0003, pg. 4, section 3.3.1.

<sup>6</sup> Informal comments, provided by BNFL when the RU first identified this issue, indicate that BNFL believe “the 5 and 30 rem standards appeared in ISMP Revision 0. Justification is only provided for changes from Revision 0.”

Standards Above Normal Background” in response to questions submitted by the RU during the initial SRD review. However, BNFL also made a number of changes to the Table that were neither requested by the RU nor reviewed or accepted.

Due to inadequate configuration management, successive versions of BNFL Authorization Basis submittals do not show evidence of rapidly converging upon RU approval. Future submittals and reviews should manifest the elimination of issues, rather than the creation of new issues and failure to resolve old issues.

BNFL must implement an effective configuration management system to attain timely approval of authorization basis regulatory submittals. Two of the many features the configuration management system should include are precise identification of changes and clear justification of the need for the change. Delay in establishing an adequate configuration management system will likely result in delays in the regulatory approval of critical authorization basis documents.

### **3.0 EVALUATION OF CHANGES ASSOCIATED WITH CONDITIONS OF APPROVAL**

The RU evaluation (RL/REG-98-01) of “BNFL Inc. Safety Requirements Document, Revision 0” established sixteen conditions for approval. The following sections restate the condition of approval, documents the RU evaluation of BNFL action to meet the condition and, if required, identifies the action required to meet the condition.

#### **3.1 CONDITION 1 – COMPLIANCE WITH ALL OTHER APPLICABLE REGULATIONS**

The SRD must be modified to clarify its usage of the term “tailored approach,” particularly with respect to 10 CFR 830, Sections 830.1 through 830.7.

##### Evaluation

BNFL revised the *Integrated Safety Management Plan*, BNFL-5193-ISP-01, Revision 2, to define the terms “graded” and “tailoring.” Volume I of the SRD references (on page 3-7, Section 3.3.2) the ISMP for these definitions. Safety Criteria 7.2-1, 7.5-1 and 7.6-1 concerning training, operations, and maintenance, respectively, were clarified with respect to applying the use of a tailored approach (as defined in the ISMP) for these safety criteria.

The BNFL response to this condition is adequate.

#### **3.2 CONDITION 2 – DEFENSE IN DEPTH**

BNFL must modify the SRD so that SC 4.3-1 and SC 7.0-2 adequately incorporate Top-Level Principles 4.1.1.5, “Automatic Systems,” and 4.1.1.3, “Control,” respectively. These safety criteria must be modified to include all equipment important to safety instead of Design class I and II.

Additionally, BNFL must modify the SRD to include subordinate standards for all the safety criteria associated with defense in depth with the exception of SC 4.3-1.

### Evaluation

The Nuclear Safety Principle of Defense in Depth consists of the following six sub-principles: defense in depth, prevention, control, mitigation, automatic systems, and human aspects. The RU reviewers noted improvements in the presentation of defense in depth in SRD Revision 1 and ISMP Revision 3. The reviewers noted the defense in depth safety criteria of SRD Revision 1 had been revised to include equipment important to safety and the safety criteria referenced subordinate standards contained in the ISMP. However, the reviewers determined that the revised subordinate standards referred to in SRD Revision 1, which are in ISMP Revision 3, do not provide sufficient detail for a user, like a design engineer, to implement the Top-Level Principle of Defense in Depth and achieve adequate safety.

ISMP Revision 3, Section 3.1.1 (Approach to Defense in Depth) defines Defense in Depth as "...no one layer of protection is completely relied on to ensure safe operation of the facility." In contrast, the definition of Defense in Depth in the Contract is "...several layers of protection including successive barriers preventing the release of radioactive materials to the workplace or environment." Therefore, the BNFL working definition of the term is narrower than the Contract's.

In ISMP Revision 3, BNFL revised Section 3.1.1 "Approach to Defense in Depth" and added Section 3.1.2 "Implementation of Defense in Depth" in response to the RU Evaluation Report finding that the method for implementing Defense in Depth was not acceptably described in the ISMP. ISMP Revision 3 provides an improved discussion of the implementation approach for defense in depth, but remains insufficient for a design engineer to adequately implement. The specifics needed to successfully implement the concept continue to be absent from these documents. For example, what criteria does the designer use to determine the adequacy and the number of layers of protection required for a specific hazard?

Subordinate standards that describe in detail the implementing requirements for the Defense in Depth principles of prevention, control, mitigation, automatic systems, and human aspects are identified as specific sections of ISMP Revision 3. The association of a specific Top-Level Principle with distinct Safety Criteria is provided in Attachment E to SRD Revision 1, Volume 1 (pages E-10 and E-11). Volume II of the SRD then identifies the implementing standards associated with each Safety Criterion. Table 1, below, shows the subordinate standards for each Top-Level Principle. Standards that have been added in SRD Revision 1 are highlighted.

**Table 1**  
**Subordinate Standards for Defense in Depth**

<b>DOE/RL-96-0006 Principle</b>	<b>Related Safety Criteria</b>	<b>Subordinate Standards</b>
4.1.1.1 Defense in Depth	1.0-7	ISMP – 3.1, IEEE 1023-88
	4.1-1	ISMP – 3.6, 3.1, 3.7, 3.6.3, 3.6.2, 3.6.1
4.1.1.2 Prevention	1.0-2	ISMP – 3.11, 3.7, 3.6, 3.1, 1.3.5
	4.1-1	ISMP – 3.6, 3.1, 3.7, 3.6.3, 3.6.2, 3.6
4.1.1.3 Control	7.0-2	ISMP – 3.1
4.1.1.4 Mitigation	4.2-1	ISMP – 1.3.10, 3.6, 3.7, 3.9
4.1.1.5 Automatic Systems	4.3-1	IEEE 603-1991 ISA 84.01-96
4.1.1.6 Human Aspects	4.3-6	IEEE 1023-88, ISMP 3.12
	7.3-2	ISMP 1.3-9

In referring to multiple sections of the ISMP as subordinate standards and not specifying which portions of those sections pertain to the specific Top-Level Principle little insight is afforded the end-user in exactly how to implement the Principle. While each of these ISMP sections touch on aspects of the six sub-principles, it is impossible to weave these fragments together in a coherent discussion of how to implement defense in depth. Therefore, as presented in the ISMP, the subordinate safety standards shown in Table 1 are not acceptable for use in design.

In summary, the ISMP material related to Defense in Depth requires additional detail that presents clear, concise subordinate standards so that the end user can effectively and precisely implement the Top-Level Principles of Defense in Depth.

#### Required Action

BNFL must revise the SRD and the ISMP to provide adequate subordinate standards for the six principles of defense in depth. The subordinate standards should be established based on the process of DOE/RL-96-0004. These standards should have sufficient detail so that the end user can consistently determine the required features and the appropriate number of layers of defense in depth required for a specific hazard.

### **3.3 CONDITION 3 – SAFETY RESPONSIBILITY**

BNFL must modify the SRD such that safety criteria conform to Top-Level Principle 4.1.2.1, “Safety Responsibility.” The proposed safety criteria (SC 7.0-1 and 7.1-3) have not clearly stated that BNFL Inc. has “ultimate responsibility for the safety of the facility.” Additionally, BNFL must modify the SRD, as cited in BNFL letter 5193-98-0023 dated January 26, 1998, to include subordinate standards for all the safety criteria associated with the four Top-Level Principles of “Safety Responsibility.”

### Evaluation

BNFL added Safety Criterion 1.0-9 to address Top-Level Principle 4.1.2.1. This Safety Criterion addresses “safe operation of the TWRS-P Facility” but not all phases of the project and the broader concept of “safety” as stated in Top-Level Principle 4.1.2.1. BNFL referenced sections of the ISMP as subordinate standards (Chapter 1, “Safety Approach to TWRS Privatization, Section 11.1, “Design and Construction Phase” and Section 11.2, “Operations Phase”).

The reviewers found that ISMP Section 3.2, “Safety Responsibilities” adequately addresses ultimate responsibility in accordance with Top-Level Principle 4.1.2.1. The revised section acknowledges that BNFL has ultimate corporate responsibility and does not restrict this responsibility to the “safe operation of the TWRS-P Facility.”

Regarding the second part of the condition, the reviewers found that BNFL adequately incorporated the ad hoc standards into the SRD.

In reviewing Safety Criteria 4.3-1 and 7.0-2, the reviewers determined that BNFL inserted Top-Level Principles 4.1.1.5, and 4.1.1.3 as required. Therefore, this part of the Condition of Approval is met.

For Safety Criterion 7.0-2, BNFL selected as an *ad hoc* subordinate standard ISMP Section 3.1, “Defense in Depth.” Section 3.1 is unsatisfactory as an *ad hoc* standard because there is no discussion in Section 3.1 on “automatic systems” or “control” of important to safety structures, systems and components (SSCs). To meet this part of the Condition of Approval BNFL shall revise the ad hoc standard or select another implementing code or standard.

### Required Actions

- 1) BNFL must revise Safety Criterion 1.0-9 to address ultimate safety on a broader scope than just “safe operation of the TWRS-P Facility.” A standard equivalent to Section 3.2 of the ISMP would serve as an appropriate alternative. This Part A condition shall be corrected before the start of preliminary design.
- 2) BNFL must revise the implementing standard for Safety Criterion 7.0-2 (ISMP Section 3.1) to include implementing standards on “automatic systems” and “control” of important to safety SSCs.

## **3.4 CONDITION 4 – AUTHORIZATION BASIS**

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BNFL must modify the SRD, as cited in BNFL letter 5193-98-0023 dated January 26, 1998, to include subordinate standards for all the safety criteria associated with the Top-Level Principle of “Authorization Basis.” The authorization basis subordinate standards must reflect the ISMP commitment to clarify the content of the authorization basis and to equate the authorization basis to the licensing basis referenced in the SRD and the ISMP.

### Evaluation

SRD (Volume I) Revision 1, Appendix E indicates that Safety Criteria 9.1-1, 9.1-4, 9.1-5, 9.2-1, and 9.2-4 establish subordinate standards which implement Top-Level Principle 4.1.3.1, “Authorization Basis.” These safety criteria were reviewed and it was determined that they address certain administrative control features related to Safety Analysis Reports (SARs) and Technical Safety Requirements (TSRs), which are part of the authorization basis. However, the Authorization Basis as defined in DOE/RL-96-0006 contains many elements other than the SAR and TSR. In addition, the identified safety criteria do not address standards that will ensure that the Authorization Basis is maintained current as described Top-Level Principle 4.1.3.1.

### Required Action

Before the start of preliminary design, BNFL shall revise the SRD to establish standards that conform to Top-Level Principle 4.1.3.1. (The RU has issued RL/REG-97-13, Revision 3, which describes an acceptable approach with regard to the information included within the Authorization Basis and the process associated with ensuring that the integrity of the Authorization Basis is maintained. Conformance to RL/REG-97-13, Revision 3 is required by Standard 4 of the new contract.)

## **3.5     CONDITION 5 – PROVEN ENGINEERING PRACTICES**

BNFL must modify the SRD to adequately conform to the Top-Level Principles for “Proven Engineering Practices and Margins.” Top-Level Principle 4.2.2.2, “Common-Mode/Common-Cause,” and Top-Level Principle 4.2.2.3, “Safety System Design and Qualification,” do not conform because all aspects of the principles were not addressed. For Top-Level Principle 4.2.2.2, Safety Criteria 4.1-3, 4.1-4 and 4.3-3 only address the effect of natural phenomenon and hazards and not all categories of potential hazards. The reviewers also noted that SC 4.1-3 and SC 4.1-4 establish seismic design criteria for which BNFL has not provided an adequate safety basis (see Section 3.3.1.3 “of the RU Evaluation Report of the BNFL SRD”). Additionally, these safety criteria only address Design Class I and Design Class II SSCs, and not all SSCs “important to safety.” With respect to Top-Level Principle 4.2.2.3, Safety Criterion only addresses Design Class I mechanical and electrical equipment instead of all SSCs “important to safety.” In addition, BNFL must modify the SRD to include adequate subordinate standards for Top-Level Principle 4.2.2.4, “Codes and Standards.”



## Evaluation

- 1) Safety Criteria 4.1-3 and 4.1-4 apply only to Natural Phenomenon Hazards (NPH) design. Top-Level Principle 4.2.2.2, Common-Mode/Common-Cause, is cited as a Regulatory Basis in each of these criteria. Top-Level Principle 4.2.2.2 states that, “Design provisions should be included to limit the loss of safety functions due to damage to **several** structures, systems, or components (emphasis added).…” Criterion 4.3-3 states, “Redundancy and independence designed into the protection system shall be sufficient to ensure that (1) no **single** failure (including common mode and common cause) results in loss of the protection function (emphasis added).…” The BNFL safety criteria text is unchanged from the Revision 0 text and clearly takes exception to the Top-Level Principle language. Therefore, this Safety Criterion has not been revised to conform to Top-Level Principle 4.2.2.2.
- 2) Top-Level Principle 4.2.2.3 has been added as a Regulatory Basis for Safety Criteria 4.1-2, 4.4-2, and 4.4-3. Inclusion of 4.2.2.3 in 4.1-2 extends the Top-Level Principle to all SSCs Important-to-Safety. Safety Criteria 4.4-2 and 4.4-3 define the application of safety system design and qualification to Safety Design Class (SDC) and Safety Design Significant (SDS) SSCs, respectively. Safety Criterion 4.4-2 has adequate subordinate standards. However, a qualifying asterisk in the Criterion text appears to take exception to the environmental qualification aspect of Top-Level Principle 4.2.2.3 for a majority of operating conditions. Safety Criterion 4.4-2 states; “Environmental qualification of Safety Design Class electrical and mechanical equipment located in a mild environment before and during an accident **is not required** (emphasis added). A mild environment is an environment that would at no time be significantly more severe than the environment that would occur during normal facility operations, including anticipated operational occurrences. In addition, aging need not be considered for equipment located in a mild environment during normal operations even though it may be exposed to a harsh environment during and following accidents.” BNFL is not permitted to make exceptions to the Top-Level Principles in the Safety Criterion. BNFL may, however, develop an approach and rationale within the implementing codes and standards for evaluating and determining when environmental qualification and aging are not required in the design of individual electrical and mechanical systems. Safety Criterion 4.4-3 also contains an asterisk but without any qualifying statements. The reviewers assume that the intent of the asterisk here is similar to the qualifying statement contained in Criterion 4.4-2 and raise the same objection to it. In addition, the subordinate standard selected for Criterion 4.4-3 is ISMP Section 13.11, “Safety System Designs.” The text of this ISMP section states, “...While suppliers of Safety Design Significant systems and components are not specifically required to provide test results relative to aging...” This statement contradicts Top-Level Principle 4.2.2.3, “...The effects of aging on normal and abnormal functioning should be considered in design and qualification.”
- 3) In response to the last sentence of this Condition for Approval, BNFL added subordinate standards documents P001/2, “Rules for the Design of Piping Systems,” and V001/2, “Rules for the Design of Vessels,” into Safety Criterion 4.2-3. These documents were reviewed and found to adequately address vessel and piping erosion/corrosion programs and in-service inspections per the requirements of Top-Level Principle 4.2.2.4, “Codes and Standards.”

### Required Actions

- 1) Prior to the start of preliminary design, BNFL must revise Safety Criterion 4.3-3 to conform to the Common-Mode/Common-Cause requirements of Top-Level Principle 4.2.2.2.
- 2) Prior to the start of preliminary design, BNFL must revise Safety Criteria 4.1-2, 4.4-2, and 4.4-3 to eliminate qualifying statements to and contradictions with Top-Level Principle 4.2.2.3.

### **3.6 CONDITION 6 – INHERENT/PASSIVE SAFETY CHARACTERISTICS**

BNFL must modify the SRD to include adequate subordinate standards for Top-Level Principle 4.2.5.1 “Safety Margins Enhancement.”

#### Evaluation

BNFL cited consensus and *ad hoc* standards under Safety Criterion 4.1-2 that address safety margin enhancement. The reviewers find the subordinate standards and the BNFL response to this condition are adequate.

### **3.7 CONDITION 7 – HUMAN FACTORS**

BNFL must modify the SRD to conform to Top-Level Principle 4.2.6, “Human Factors.” Safety Criterion 4.3-4 and Safety Criterion 4.3-6 do not adequately incorporate or conform to this principle because these criteria address only Design Class I and II equipment and not, as a minimum, all equipment “important to safety.”

#### Evaluation

BNFL revised Safety Criteria 4.3-4 and 4.3-6 to apply to all equipment important to safety. Top-Level Principle 4.2.6 consists of sub-parts 4.2.6.1, “Human Error,” 4.2.6.2, “Instrumentation and Control Design,” and 4.2.6.3, “Safety Status.” These principles are implemented by Safety Criteria 4.3-4, 4.3-6, and 4.3-7. The reviewers find the revised subordinate standards and the BNFL response to this condition adequate.

### **3.8 CONDITION 8 – RELIABILITY, AVAILABILITY, MAINTAINABILITY, INSPECTABILITY**

BNFL must modify the SRD to conform to Top-Level Principle 4.2.7.1, “Reliability.” The SRD did not provide a Safety Criterion or subordinate standards for this principle. In addition, Safety Criterion 4.4-3 must be changed to apply to all SSCs “important to safety.”

#### Evaluation

In response to the first part of Condition 8, BNFL added Top-Level Principle 4.2.7.1 as a Regulatory Basis in Safety Criterion 4.4-4 (previously 4.4-3). Top-Level Principle 4.2.7.1 was

also added as a Regulatory Basis to Safety Criterion 7.6-3 (in response to RU Question 189). In response to the second part of Condition 8, BNFL revised Safety Criterion 4.4-4 to apply this Safety Criterion to all important to safety structures, systems, and components.

Top-Level Principle 4.2.7.1, "Reliability," states; "Reliability targets should be assigned to structures, systems, and components or functions important to safety. The targets should be consistent with the roles of the structures, systems and components or functions in different accident conditions. Provisions should be made for appropriate testing and inspection of structures, systems, and components for which reliability targets have been set." The text of Safety Criterion 4.4-4 does not paraphrase or emphasize any of this language. Rather the text remains a verbatim restatement only of Top-Level Principle 4.2.7.2, "Availability, Maintainability, and Inspectability." This Top-Level Principle requires that SSCs important to safety "be designated, designed and constructed for appropriate inspection, testing and maintenance...." BNFL must expand the Safety Criterion's statement to make clear its full application. Safety Criterion 4.4-4 cites ISMP Section 3.13 as a subordinate standard for Top-Level Principle 4.2.7.1. However, the requirement for reliability targets is mentioned in a single sentence in this ISMP section; "Reliability targets are assigned to SSCs only when a quantitative value has been credited for the reliability of an SSC in safety analysis." This language is narrower than Top-Level Principle 4.2.7.1, since it does not assign reliability targets for all SSCs or functions important to safety. BNFL must expand the subordinate standard to be consistent with the Top-Level Principle.

The reviewers assessed the subordinate standards of Safety Criterion 7.6-3 to determine how BNFL intended to implement Top-Level Principle 4.2.7.1. The reviewers found none of the cited codes or standards apply to Top-Level Principle 4.2.7.1. The reviewers assessed the subordinate standards of Safety Criterion 7.6-3 to determine how BNFL intended to implement Top-Level Principle 4.2.7.1. The reviewers found none of the cited codes or standards apply to Top-Level Principle 4.2.7.1. ISMP Section 1.3.10 describes how safety design class and safety design significant are applied to SSCs. Section 3.2, "Safety Responsibility," describes at a high level how safety roles will be assigned within the TWRS-P team during the different phases of the project. Section 3.4, "Safety/Quality Culture," and subsections out of Section 3.16, "Internal Safety Oversight," present various aspects of implementing and tracking self-assessment and continual improvement programs. These are focused on organizational effectiveness, staff training and communication, and review and evaluation of work processes, e.g., procedures and work controlling documents. Finally, Section 10.0, "Assessments," describes formalized management assessments to verify that public and worker safety considerations are reflected in TWRS-P activities throughout each phase of the project. Related to operations these areas include radiation control, unreviewed safety questions evaluations, compliance with the authorization basis, maintenance training and work performance, hazardous waste management, emergency exercises, compliance to deactivation end point criteria, and fire protection. No mention is made of provisions for appropriate testing and inspection of SSCs important to safety for which reliability targets have been set. BNFL shall identify and cite an appropriate implementing code or standard to satisfy this condition of approval.

In summary, the BNFL response for this Condition for Approval is only partially accepted pending acceptable resolution of the deficiencies described above.

#### Required Action

- 1) Prior to starting preliminary design, Safety Criterion 4.4-4 must be modified so that it requires SSCs to be designated designed and constructed for appropriate inspection, testing and maintenance.

- 2) Prior to starting preliminary design, ISMP Section 3.13, which is the subordinate standard for Safety Criterion 4.4-4, must be modified to assign reliability targets to all SSCs important to safety.
- 3) Prior to preliminary design, BNFL must identify and cite appropriate implementing codes or standards for Safety Criterion 7.6-3 that implements Top-Level Principle 4.2.7.1.

### **3.9 CONDITION 9 – PRE-OPERATIONAL TESTING**

BNFL must modify the SRD to conform to Top-Level Principle 4.2.8, “Pre-Operational Testing.” Of the four principles associated with “Pre-Operational Testing,” BNFL does not adequately conform to three. BNFL does not adequately conform to Top-Level Principle 4.2.8.1, “Testing Program,” Top-Level Principle 4.2.8.3, “Safety Systems Data,” and Top-Level Principle 4.2.8.4, “Design Operating Characteristics,” because the proposed safety criteria address only Design Class I and II SSCs, and not all SSCs important to safety. BNFL provided adequate ad hoc subordinate standards in the ISMP for the four principles; however, these standards must be incorporated by reference in the SRD.

#### Evaluation

The BNFL response to Condition 9 provides *ad hoc* standards based on sections of the ISMP. The reviewers considered ISMP Revision 3 sections 1.3.14, “Startup Testing,” 3.14, “Startup Testing and Operation,” and 5.6.4, “Startup Review” for the closure of Condition 9. The sections were considered in their entirety based on the Implementing Codes and Standards listed by BNFL in safety criteria 6.0-1, 6.0-2, 6.0-3 and 6.0-4.

The reviewers found that the SRD was revised to address all SSCs important to safety. The SRD does reference portions of the ISMP, which are utilized as ad hoc standards. These ad hoc standards are acceptable for design. However, the proposed subordinate standards are insufficient because the description provided is inadequate to implement the pre-operational testing principle. For example, the cited *ad hoc* standards do not describe the general scope and depth of the program. In addition, they do not provide criteria for selecting plant features to be tested, prerequisites for testing, scope, test conditions, or length of testing.

#### Required Action

Prior to the Authorization of Construction, BNFL must modify the SRD to conform completely to Top-Level Principle 4.2.8.

### **3.10 CONDITION 10 – CONDUCT OF OPERATIONS**

BNFL must modify the SRD to conform to the “Conduct of Operations” Top-Level Principle. BNFL Safety Criteria did not adequately conform to the Top-Level Principle for “Conduct of Operation” for the following reasons. Safety Criterion 7.0-4 does not adequately address or incorporate the “full safety responsibility” aspect of Top-Level Principle 4.3.1.1, “Organizational Structure.” Safety Criteria 7.5-2, 7.2-2 and 7.2-4 do not adequately incorporate the “operator experience and qualifications and minimum requirements for the availability of staff or

equipment” aspects of Top-Level Principle 4.3.1.4, “Readiness.” Safety Criterion 7.1-3 does not adequately address or incorporate the procedure aspect of Top-Level Principle 4.3.1.5, “Internal Surveillance and Audits.”

In addition, although adequate ad hoc subordinate standards are described in the ISMP for the four principles, these standards must be incorporated by reference in the SRD.

#### Evaluation

BNFL added Safety Criterion 1.0-9 to address “full safety responsibility.” In addition, BNFL incorporated the following ISMP Sections as subordinate standards for the listed safety criteria:

<b>Safety Criterion</b>	<b>ISMP Sections</b>
7.0-4	3.2, “Safety Responsibilities,” and 6.1.2, “Lines of Authority and Responsibility”
7.5-2	1.3.15, “Operations”
7.2-2	3.15, “Training and Qualification”
7.2-4 (now 7.2-3)	5.6.3, “Development of the Operator Training Program”
7.1-3	3.16, “Internal Safety Oversight,” 10.0, “Assessments,” and 1.3.13, “Procedures”

The BNFL response to this condition is adequate. In accordance with Section 3.2.3.3.1 of RL/REG-98-01, Revision 0, “DOE Regulatory Unit Evaluation Report of the BNFL Inc. Safety Requirements Document,” BNFL’s incorporation of the ad hoc subordinate standards (i.e., the ISMP Sections specified above) adequately resolves this condition.

### **3.11 CONDITION 11 – EMERGENCY PREPAREDNESS**

BNFL provided adequate ad hoc subordinate standards in the ISMP for the three principles of emergency preparedness; however, these standards must be incorporated by reference in the SRD.

#### Evaluation

BNFL incorporated the following ISMP Sections as subordinate standards for the listed safety criteria:

<b>Safety Criterion</b>	<b>ISMP Sections</b>
7.8-3	3.10, “Emergency Preparedness,” and 1.3.18, “Emergency Planning”
7.8-4	3.10, “Emergency Preparedness”
7.8-5	3.10, “Emergency Preparedness”

The BNFL response to this condition is adequate. In accordance with Section 3.2.3.3.3 of RL/REG-98-01, Revision 0, “DOE Regulatory Unit Evaluation Report of the BNFL Inc. Safety Requirements Document,” BNFL’s incorporation of the ad hoc subordinate standards (i.e., the ISMP Sections specified above) adequately resolves this condition.

### 3.12 CONDITION 12 – TRAINING AND QUALIFICATION

BNFL provided adequate ad hoc subordinate standards in the ISMP for the three principles of training and qualification; however, these standards must be incorporated by reference in the SRD.

#### Evaluation

BNFL incorporated the following ISMP Sections as subordinate standards for the listed safety criteria:

Safety Criterion	ISMP Sections
7.2-1	1.3.12, “Training,” 3.15, “Training and Qualification,” and 4.2.2, “Training and Procedures”
7.2-1	3.15, “Training and Qualification”
7.2-4 (now 7.2-3)	5.6.3, “Development of the Operator Training Program”

The BNFL response to this condition is adequate. In accordance with Section 3.2.3.3.4 of RL/REG-98-01, Revision 0, “DOE Regulatory Unit Evaluation Report of the BNFL Inc. Safety Requirements Document,” BNFL’s incorporation of the ad hoc subordinate standards (i.e., the ISMP Sections specified above) adequately resolves this condition.

### 3.13 CONDITION 13 – OPERATIONAL TESTING, INSPECTION, AND MAINTENANCE

BNFL must modify the SRD to conform Top-Level Principle 4.3.5.1, “Operational, Testing, Inspection and Maintenance.” Safety Criteria 7.6-2 through 7.6-4 do not adequately conform because the safety criteria address only Design Class I and II SSCs, and not all components “important to safety.”

#### Evaluation

BNFL responded to this condition by modifying Safety Criteria 7.6-2 and 7.6-3 to address all components important to safety. The issue of the SRD addressing all SSCs important to safety is corrected.

While adequate for design, the reviewers determined that do not fully conform to Top-Level Principle 4.3.5.2 because insufficient implementing description is provided for the operational

testing inspection and maintenance principle.

#### Required Action

Prior to the Authorization for Construction, BNFL must revise the SRD (Safety Criteria 7.6-2 and 7.6-3) to provide adequate subordinate standards for operational testing and maintenance.

### **3.14 CONDITION 14 – INTERNAL SAFETY OVERSIGHT**

BNFL must modify the SRD to conform to Top-Level Principle 4.4, “Internal Safety Oversight.” The BNFL SRD did not propose a standard or subordinate standard for Top-Level Principle 4.4.3, “Recommendation for Initiation of Construction,” BNFL must also modify the SRD to include adequate subordinate standards for Top-Level Principle 4.4.2, “Qualified Personnel.”

#### Evaluation

BNFL added Safety Criterion 9.0-2 to SRD Revision 1 in response to the first part of this condition. Safety Criterion 9.0-2 is a verbatim restatement of Top-Level Principle 4.4.3. BNFL cited Section 9.2, “Scheduling of Events for Regulatory Submittals,” of the ISMP Revision 3, as the implementing standard for this principle.

This implementing standard is unacceptable as a subordinate standard for Top-Level Principle 4.4.3. The standard does not amplify on the corresponding Safety Criterion with respect to any of the key attributes of this criterion; i.e., the need for a specific request, the prerequisites for that request, or the solubility of outstanding safety issues. ISMP Section 9.2 does not appear relevant to the criterion at all.

The second aspect of Condition 14 was to include adequate subordinate standards for Top-Level Principle 4.4.2, “Qualified Personnel.” BNFL did not identify a change to the SRD that accomplished this, and the reviewer was unable to find one. Therefore, this portion of Condition 14 was also not met.

#### Required Action

Prior to Construction Authorization, BNFL shall provide subordinate standards that effectively implement Top-Level Principles 4.4.2 and 4.4.3.

### **3.15 CONDITION 15 – GENERAL PROCESS SAFETY OVERALL PRINCIPLES**

BNFL must modify the SRD to conform to Top-Level Principle 5.1, “General Process Safety Overall Principles.” BNFL did not adequately incorporate or conform to Top-Level Principle 5.1.1, “Process Safety Management,” because a Safety Criterion has not been proposed which clearly states that BNFL Inc. has “ultimate responsibility” for facility process safety. Additionally, BNFL must incorporate, by reference, applicable sections of the ISMP into the SRD as subordinate standards for all the safety criteria associated with “General Process Safety Overall Principles.”

### Evaluation

The reviewers evaluated Safety Criterion 1.0-9 to determine whether the new standard adequately addresses “ultimate responsibility for facility process safety” as required by the condition. The reviewers also evaluated whether BNFL adequately incorporated, by reference, applicable sections of the ISMP into the SRD as subordinate standards for all the safety criteria associated with “General Process Safety Overall Principles.”

BNFL added Safety Criterion 1.0-9 to their SRD to address “General Process Safety Overall Principles.” This new standard states that “BNFL Inc. shall accept ultimate responsibility for the safe operation of the TWRS-P Facility.” The standard also identifies three subordinate standards. Safety Criterion 1.0-9 does not adequately conform to Top-Level Principle 5.1.3, “Process Safety Responsibility” because the new standard does not satisfy the intent of the principle. Safety criterion 1.0-9 does not clearly state that BNFL Inc. has “ultimate responsibility for facility process safety” (RL/REG-98-01, page 75); ultimate responsibility for the safe operation of the TWRS-P facility is a more limited standard.

### Required Action

Prior to beginning preliminary design, BNFL shall revise safety criteria to establish standards that conform to Top-Level Principle 5.1.3, “Process Safety Responsibility.”

## **3.16 CONDITION 16 – PROCESS SAFETY MANAGEMENT PROGRAM**

BNFL must modify the SRD to conform to Top-Level Principle 5.2, “Process Safety Management Program.” The BNFL SRD does not conform to Top-Level Principle 5.2.6, “Pre-startup Safety Review,” because SC 6.0-5 does not require that the Contractor submit the results of their pre-startup reviews to the Director of the Regulatory Unit for evaluation and in support of authorization decisions and regulatory oversight. Additionally, the BNFL SRD must be modified to include subordinate standards for 9 of the 12 Top-Level Principles of “Process Safety Management Program.” By reference, BNFL must incorporate applicable section of the ISMP in the SRD as subordinate standards.

### Evaluation

SRD Volume 1, Appendix E, indicates that SRD Safety Criteria 6.0-5 and 9.0-3 establish subordinate standards that implement Top-Level Principle 5.2.6, “Pre-startup Safety Review.” The reviewers examined Safety Criteria 6.0-5 and 9.0-3 (new). Safety Criterion 6.0-5 requires that a pre-startup safety review shall be performed. Safety Criterion 9.0-3 states that the results of the pre-startup safety review should be submitted to the Director of the Regulatory Unit for evaluation and in support of authorization decisions and regulatory oversight. The reviewers determined that Safety Criterion 9.0-3, in conjunction with Safety Criterion 6.0-5, conforms to Top-Level Principle 5.2.6 “Pre-startup Safety Review.”

The SRD Evaluation Report also determined that BNFL must include subordinate standards for 9 of the 12 Top-Level Principles of “Process Safety Management Program.” The reviewers examined SRD Revision 1 for subordinate standards for the Top-Level Principles 5.2.1 “Process



Safety Information,” 5.2.2 “Process Hazard Analysis,” 5.2.3 “Operating Procedures,” 5.2.4 “Training,” 5.2.5 “Subcontractors,” 5.2.6 “Pre-startup Safety Review,” 5.2.7 “Mechanical Integrity,” 5.2.9 “Management of Change,” and 5.2.12 “Compliance Audits.” In SRD Revision 1, BNFL proposes various sections of the ISMP as subordinate standards for safety criteria conforming to 11 of the Top-Level Principles of “Process Safety Management.”

For Safety Criterion 3.1-6, which conforms to Top-Level Principle 5.2.2, “Process Hazard Analysis,” BNFL proposes document K0104\_REP\_SAF, “Process Hazard Analysis Procedure for TWRS-P” as the subordinate standard. The reviewers determined that the relevance of the proposed subordinate standards for the safety criteria varies considerably.

Some subordinate standards proposed by BNFL contain significant deficiencies as described below:

- 1) ISMP Section 5.1, “Process Safety Information” is the proposed subordinate standard for Safety Criterion 3.1-2. Process safety information is intended to provide a foundation for identifying and understanding the process hazards. However, ISMP Section 5.1 refers to “highly hazardous chemicals,” a term restricted by 29 CFR 1910.119, OSHA's Process Safety Management (PSM) Standard, to certain chemicals listed in Appendix A of the PSM Standard.
- 2) K0104\_REP\_002\_SAF, “Process Hazard Analysis Procedure for TWRS-P” was reviewed to determine if this BNFL procedure is appropriate as a subordinate standard for Safety Criterion 3.1-6. The reviewers could not determine if this procedure is the same as that in K0104\_REP\_SAF Issue 3, specified in SRD Revision 1, Volume 1. In any case, the procedure is unsatisfactory as a subordinate standard. The procedure is concerned with providing hazard analysis results solely to the TWRS-P process designers. Safety Criterion 3.1-6 is directed at hazard analyses during operations. It concerns “a system...to promptly address the hazard analysis team's findings and recommendations...communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.” The reviewers determined that the procedure’s deficiency results from a narrow focus on providing information “important to safety” to a specific group of employees (the process designers) rather than to a wider group including operating and maintenance personnel.
- 3) ISMP Section 9.2, “Scheduling of Events for Regulatory Submittals” is proposed as a subordinate standard for Safety Criterion 9.0-3. ISMP Section 9.2 is unsatisfactory as a subordinate standard because it does not refer to pre-startup safety reviews and is not directly relevant to Safety Criterion 9.0-3. The reviewers determined that the deficiency of ISMP Section 9.2 results from a lack of scope and failure to include pre-startup safety reviews among the documents to be submitted for regulatory approval.
- 4) Additionally, ISMP Section 5.6.6, “Hot Work Operations” is proposed as a subordinate standard for Safety Criterion 4.5-23. However, ISMP Section 5.6.6 inappropriately refers to Safety Criterion 4.5-19, the old SRD Revision 0 number for Safety Criterion 4.5-23.

- 5) The reviewers examined SRD Revision 1 for changes to those safety criteria subordinate to Top-Level Principle 5.2, "Process Safety Management." The SRD Evaluation Report determined Safety Criteria 7.7-1, 7.7-2, and 7.7-3 "in conjunction with Safety Criteria 7.7-4 through 7.7-9 are adequate as subordinate standards as these criteria describe how the incident investigation program will be implemented."
- 6) The reviewers found that Safety Criterion 7.7-9 had been modified by BNFL in SRD Revision 1. This revision removes the requirement that subcontractors and suppliers comply with the requirements of 10 CFR 830.350 (b) and (e) with respect to reporting of defective items, materials, and services. The transmittal letter that accompanied SRD Revision 1 stated that Safety Criterion 7.7-9 had been modified in response to a "PSC comment." No rationale for the modification was provided.
- 7) Table "DOE/RL-96-0006 Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors" (Sheet 8) on page E-17 tabulates the DOE/RL-96-0006 Top-Level Principles and the safety criteria that BNFL relies on to achieve conformance to the Principle. BNFL did not revise the table to include Safety Criteria 3.1-2 and 3.1-4 to achieve conformance with Top-Level Principle 5.2.2, "Process Hazard Analysis." Likewise, BNFL lists Safety Criterion 4.0-2 as corresponding to Top-Level Principle 5.2.10, "Incident Investigation," but fails to acknowledge that the SRD Evaluation Report linked Safety Criterion 7.4-1 with Safety Criterion 4.0-2 to achieve conformance with the Top-Level Principle 5.2.10.

#### Required Action

- 1) Prior to the Authorization for Construction, BNFL must delete the modifying adjective "highly" from ISMP Section 5.1 when defining the applicability of the subordinate standard to hazardous chemicals (as BNFL did for Safety Criterion 3.1-2).
- 2) Prior to the Authorization for Production Operation, BNFL must revise the Process Hazard Analysis Procedure to reflect Safety Criterion 3.1-6's intent that the hazard analysis team's findings and recommendations be communicated to operating, maintenance and other employees who may be affected by the recommendations or actions.
- 3) Prior to the Authorization for Production Operations, BNFL must provide an adequate subordinate standard for Safety Criterion 9.0-3 that includes the requirement for pre-startup safety reviews.
- 4) Prior to the Authorization of Production Operations, BNFL must correct ISMP Section 5.6.6 to refer Safety Criterion 4.5-23 instead of Safety Criterion 4.5-19.
- 5) Prior to beginning preliminary design, BNFL must provide justification for modifying Safety Criterion 7.7-9 to delete the requirement that subcontractors and suppliers comply with 10 CFR 830.350 (b) and (e).
- 6) Prior to the start of preliminary design, BNFL must revise Table "DOE/RL-96-0006 Top-

Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors” (Sheet 8) on page E-17. Safety Criteria 3.1-2 and 3.1-4 must be added to achieve conformance with Top-Level Principle 5.2.2, “Process Hazard Analysis” and Safety Criterion 7.4-1 to achieve conformance with the Top-Level Principle 5.2.10.

## **4.0 EVALUATION OF SRD REVISION 1 CHANGES**

The reviewers evaluated how BNFL modified safety criteria and subordinate standards in response to RU questions. The RU evaluation documented the review of BNFL commitments by SRD Volume (Volume 1 then Volume 2). The review of SRD Volume 2 is documented by chapter. The results of this evaluation are shown below. In a few cases, the reviewers identified new issues. These are shown separately within the applicable volume and chapter.

### **4.1 SRD VOLUME 1**

#### Evaluation

SRD Volume 1 describes the process used by BNFL to identify the safety criteria in the SRD; however, BNFL provided little rationale for the selection of new subordinate standards. These new standards sometimes refer to sections of the ISMP as discussions of how the safety criteria will be implemented. In addition, Section 5.1, “Selected Consensus Codes and Standards” lists 25 consensus standards shown in Volume II as “Implementing Codes and Standards.” In neither instance is the subordinate standard readily traceable to the definition of work, identification of hazards, nor hazard control strategies in the manner anticipated by integrated safety management.

This issue was raised in the RU Evaluation Report of the BNFL ISMP (RL/REG-98-03), which states:

“(T)he reviewers determined NFL has not followed the rigorous process of identifying and characterizing hazards, developing control strategies, and documenting the set of standards and requirements necessary to ensure implementation of the control strategies specified in DOE/RL-96-0003.”

The ISMP Evaluation Report required:

“BNFL must take action prior to Part B to ensure their integrated safety management process is implemented as required by the Contract.”

Specific comments on the safety criteria and subordinate standards are provided in Section 3.2, “SRD Volume 2,” below.

### Required Action

Prior to the start of preliminary design, BNFL must demonstrate how the ISM process was used to select subordinate standards (Section 1.1 of this evaluation report discusses establishing subordinate standards).

## **4.2 SRD VOLUME 2**

The following is a summary of the results of the review of SRD Revision 1, Volume 2. The issues described in Section 4.2 must be resolved either prior to the start of preliminary design, or before submittal of the CAR, as noted.

### **a. Radiological, Nuclear and Process Safety Objectives (Chapter 1)**

#### *Safety Criterion 1.0-2*

#### Evaluation

Safety Criterion 1.0-2 cites ISMP Section 1.3.5 “Facility Design/Development Activities and Safety Features Identification” as a subordinate standard. The ISMP section is no more specific than the Safety Criterion. In addition, Section 1.3.5 refers to Section 3.7 “Proven Engineering Practices,” Section 3.5 “Quality Assurance Program (QAP),” Section 1.3.16, “Configuration Management,” and Section 5.3 “Configuration Management.” While each of these sections has elements that support Top-Level Principle “Defense in Depth – Prevention.”

#### Required Action

Prior to the start of preliminary design, BNFL must tailor these identified sections of the ISMP to the safety criteria. The ad hoc standards lack specificity to achieve conformance.

#### *Safety Criterion 1.0-3*

#### Evaluation

Safety Criterion 1.0-3 cites ISMP Chapter 12, “Definitions,” as a subordinate standard. This Chapter is too general to be a subordinate standard to address the Top-Level Principle 3.1.2, “Accident Risk Goal.”

#### Required Action

BNFL must clarify which definitions it intends to apply to Safety Criterion 1.0-3.

#### *Safety Criteria 1.0-2, 1.0-6, and 1.0-7*

#### Evaluation

These Safety Criteria cite ISMP Section 3.1 as a subordinate standard. A change has been made

to the approved ISMP that decreases conformance with these standards. The second line from the end of the second paragraph of Section 3.1.1 was deleted. This line stated that “Defense in depth means that no single failure of protection will allow the hazardous situation to occur.”

#### Required Action

BNFL must provide the rationale for striking out this sentence, considering that Top-Level-Principle 4.1.1.1 states “...safety is vested in multiple, independent safety provisions, no one of which is to be relied upon excessively to protect the public, the workers and the environment.” This issue must be corrected before the start of preliminary design.

#### *Safety Criterion 1.0-8*

#### Evaluation

SC 1.0-8 addresses “important-to-safety.” Per RL/REG-98-01 Question 33, BNFL committed to remove references to Design Class from the text of the SRD and ISMP. For Chapter 1, BNFL met this commitment. Within the text of Safety Criteria 1.0-8 and ISMP Section 1.3.10 “Classification of Structures, Systems and Components,” BNFL has introduced the term “Safety Design Significant.” This Safety Criterion has changed the definition of “important to safety.” The change is consistent with the unapproved BNFL submitted change to the Glossary of DOE/RL-96-0003 and 0006 (Letter # W338-98-0021, April 1, 1998). This change is unacceptable.

#### Required Action

Prior to the start of preliminary design, BNFL must revise Safety Criterion 1.0-8 to be consistent with the contract definition provided in DOE/RL 96-0006 and the ISMP.

### **b. Radiological and Process Standards (Chapter 2)**

#### *Question #158*

#### Evaluation

The changes to Table 2-1 that were reviewed and evaluated with respect to RL/REG-98-01 Question #158 included the changes related to ALARA design limits for workers and co-located workers for Normal Events. BNFL incorporated changes to these two elements of Table 2-1 and added footnote 1, in accordance with the commitments made in response to RL/REG-98-01 Question #158. The changes were found to adequately implement the commitments made in response to this question.

#### *Question #159*

#### Evaluation

The changes to Table 2-1 that were reviewed and evaluated with respect to RL/REG-98-01 Question #159

included changes related to ALARA design limits for workers and collocated workers for Anticipated Events, Unlikely Events, and Extremely Unlikely Events. BNFL incorporated changes to these six elements of Table 2-1 and footnotes 2-4, in accordance with the commitments made in response to RL/REG-98-01 Question #159. The changes were found to adequately implement the commitments made in response to this question.

### **c. Nuclear and Process Safety (Chapter 3)**

#### *Safety Criterion 3.2-1*

##### Evaluation

RL/REG-98-01 Question 119 observed that no subordinate standard was provided for the accident analysis Safety Criterion (Safety Criterion 3.2-1) and requested that a standard be referenced in the revised SRD. Safety Criterion 3.2-1 is a restatement of Top-Level Principle 4.2.1.2 in DOE/RL-96-0006. In attachment 3 to BNFL letter W338-98-0103, the justification for the change in Safety Criterion 3.2-1 states that “Accident Analysis Procedure (ESH-03-TWRS)” was added as a subordinate standard. However, ESH-03-TWRS is still not referenced in the revised Safety Criterion 3.2-1. Moreover, a review of ESH-03-TWRS found no strategy for the application of risk-based analysis for the prevention of risk dominant accidents.

In addition, Safety Criterion 3.2-1 references ISMP sections 1.3 and 3.10 as subordinate standards. The reviewers found it difficult to identify relevant material in 1.3 or 3.10 of the ISMP. Section 1.3.6 states, “Evaluating potential accidents involves the following tasks: 1) Separating the lower-risk accidents adequately addressed by the PHA from the higher-risk accidents that warrant quantitative analysis to confirm risk acceptance guidelines are satisfied....” Section 4.6.2.2 of the ISAR contains the statement that “Events were also added (*to the list of candidates for accident analysis*) [emphasis added] for which the frequency of the initiator was estimated to be a high (i.e., perceived high risk)....” These statements appear to be relevant to Safety Criteria 3.2-1, but do not describe a coherent and organized program for application of risk-based analysis for the prevention of risk dominant accidents. Section 3.10 references Chapter 9 of the ISAR, which in turn references DOE/RL-94-02 & 40 CFR 68 Subpart B. However, these documents are not identified as subordinate standards in the SRD.

##### Required Action

Prior to construction authorization, BNFL must provide relevant subordinate standards, which describe the BNFL program for the application of risk-based analysis in the prevention of risk dominant accidents.

#### *Safety Criterion 3.3-1 to 3.3-8*

##### Evaluation

Safety Criteria 3.3-1 through 3.3-8 were modified to cite Section 3.8 (Criticality Safety) of the ISMP as a subordinate standard. In attachment 3 to BNFL letter W338-98-0103, the justification for the change in Safety Criteria 3.3-1 through 3.3-8 states that the reference to the ISMP was added in response to RL/REG-98-01 review Question 157. RL/REG-98-01 review Question 157

made a general request for the addition of subordinate standards to support the safety criteria. However, the references to Section 3.8 of the ISMP appear inappropriate. In responding to RL/REG-98-01 review Question 157, BNFL did not carefully consider the addition of the ISMP as an implementing standard in the context of the entire set of criticality safety criteria contained in Section 3.3 of the SRD. Safety Criterion 3.3-1 is a restatement of the Top-Level Principle for the prevention of criticality from section 4.2.2.5 of DOE/RL-96-0006. The review of SRD Revision 0 accepted Safety Criteria 3.3-2 through 3.3-8 as subordinate standards that support implementation of Safety Criterion 3.3-1. Safety Criteria 3.3-2 through 3.3-8 are stand-alone subordinate standards for the top-level criticality prevention principle and reference to section 3.8 of the ISMP is not required or relevant.

#### Required Action

Prior to construction authorization, BNFL must delete references to Section 3.8 of the ISMP found in Safety Criteria 3.3-1 through 3.3-8.

RL/REG-98-01 review *Question 23*

#### Evaluation

RL/REG-98-01 review Question 23 requests information about criticality hazards in vessels or tanks, which were not addressed in the Hazards Analysis Report (HAR) or SRD. RL/REG-98-01 review Question 23 is related to the criticality prevention Top-Level Principle 4.2.2.5 in DOE/RL-96-0006. In the supplemental response to RL/REG-98-01 review Question 23, BNFL made a commitment to perform criticality safety assessments covering "...all major process areas." This language is currently absent from the criticality safety criteria and the ISMP.

#### Required Action

Prior to construction authorization, BNFL must modify the ISMP or SRD to indicate that criticality safety assessments will cover "all major process areas."

RL/REG-98-01 review *Question 70*

#### Evaluation

RL/REG-98-01 review Question 70 requested more specific standards for criticality evaluation which would: 1) Indicate process components subject to criticality evaluation and process parameter sampling/analysis, and 2) Identify the methods by which criticality evaluations will be performed. RL/REG-98-01 review Question 70 is related to the criticality prevention Top-Level Principle 4.2.2.5 in DOE/RL-96-0006. BNFL's response deferred the resolution of these questions to a criticality assessment, which was to be provided in Chapter 6 of the ISAR. The RU accepted this deferral to the ISAR with the expectation that all criticality evaluation details would be provided in the ISAR. The criticality assessment that BNFL provided in the ISAR did not resolve RL/REG-98-01 Question 70. The issues are still open.

#### Required Action

Prior to Construction Authorization, BNFL shall resolve issues associated with criticality.

**d. Engineering and Design (Chapter 4)**

*Safety Criterion 4.1-3*

Evaluation

As indicated in the Initial Safety Evaluation Report (Section 3.1.1, “Geology”) the specified spectra, corresponding to a hazard exceedence probability of  $5 \times 10^{-4}$ , are not justified as being adequate based on a comprehensive hazard/consequence analysis of the facility. The RU documented this deficiency with the understanding that it would be corrected before construction authorization. Review of the current SRD revision shows that commitments related to the justification of the design basis response spectra (Figure 4-1) are partially met at this time.

Required Action

BNFL must complete a comprehensive hazard/consequence analysis of the facility prior to Construction Authorization.

*Safety Criteria 4.2-1, 4.2-2, 4.2-3, 4.3-4, and 4.3-7*

Evaluation

The attachment to RL/REG-98-01 review Question 157 states that BNFL’s “Accident Analysis Procedure,” ESH-03-TWRS, will be cited in Safety Criteria 4.2-1, 4.2-2, 4.2-3, 4.3-4, and 4.3-7 as a subordinate standard. BNFL did not add this procedure to the noted safety criteria. Commitments made by BNFL in response to RU review questions developed during the SRD Revision 0 review period are documented in Appendix C of RL/REG-98-01. The acceptance of BNFL responses made up part of the reviewers’ recommendation that the Regulatory Official conditionally accept the SRD.

Required Action

The commitment to cite BNFL’s “Accident Analysis Procedure” must be met before initiation of preliminary design and further hazard analysis to assure that the standard is applied as intended.

*Safety Criterion 4.3-2*

Evaluation

This Safety Criterion addresses the standards and codes requirements for the safety system designs that would assure protection against natural phenomena, and meet the requirements for normal operating, maintenance, testing, and postulated accident conditions. BNFL replaced the text, “Design Class I” with “Safety Design Class.” However, as now defined by BNFL in



Section 1.3.10 of the ISMP, Safety Design Significant SSCs include systems and components required to prevent worker or public exposure or injury during normal operating conditions.

#### Required Action

BNFL must revise this Safety Criterion to also apply to Safety Design Significant SSCs, i.e., to all important to safety SSCs. This revision must be completed before the start of preliminary design.

#### *Safety Criterion 4.3-5*

#### Evaluation

This Safety Criterion addresses the standards and codes requirements for the separation of safety systems from control systems. BNFL replaced the text, “Design Class I” with “Safety Design Class.” However, as Safety Design Class and Safety Design Significant SSCs are now defined by BNFL in Section 1.3.10 of the ISMP, Rev. 3, Safety Design Significant SSCs includes systems and components required to prevent worker or public exposure or injury during normal operating conditions.

#### Required Action

BNFL must revise this Safety Criterion to apply also to Safety Design Significant SSCs, i.e., to all important to safety SSCs. This revision must be completed before the start of preliminary design.

#### *Safety Criterion 4.3-7*

#### Evaluation

The regulatory bases for this Safety Criterion are Top-Level Principles 4.2.4.1, “Support Facilities” and 4.2.6.2, “Instrumentation and Control Design.” Top-Level Principle 4.2.4.1 states, “The facility design should provide additional capability to place and maintain the facility in a safe state following an accident if the normal control areas are expected to become uninhabitable.” Top-Level Principle 4.2.6.2 states, “Sufficient instrumentation and control capability should be provided so that under normal operating and postulated accident conditions the operators can diagnose facility conditions, place and maintain the facility in a safe state, and mitigate accidents. If necessary, measures should be provided to protect the operator in the performance of these functions.”

The cited implementing codes and standards, ASME N509-89 and ASME N510, address the last measure of Top-Level Principle 4.2.6.2; namely, protection of control-room operators during off-normal conditions. The remaining implementing standard, ISMP Section 1.3.7, does not adequately address the remaining requirements of the Top-Level Principles.

### Required Action

BNFL shall identify additional codes or standards that address implementation of the remaining elements of the Top-Level Principles 4.2.4.1 and 4.2.6.2 before the start of preliminary design.

### *Safety Criterion 4.4-7*

### Evaluation

This Safety Criterion was modified to apply to safety design significant SSCs. However, the text in the first sentence was not edited to remove the phrase, "...and accident conditions." Based on BNFL's definition of Safety Design Significant SSCs, in ISMP Section 1.3.10, "Classification of Structures, Systems and Components," such systems are not required to operate in accident conditions.

### Required Action

BNFL must eliminate the phrase "...and accident conditions" from the Safety Criterion text before the start of preliminary design.

### *Safety Criteria 4.4-19 and 4.4-20*

### Evaluation

Safety Criterion 4.4-19 is applied to Safety Design Class SSCs and Safety Criterion 4.4-20 is applied to Safety Design Significant SSCs. In addition, Safety Criterion 4.4-20 was modified to apply to safety design significant SSCs. However, the text in the first sentence was not edited to remove the phrase, "...and accident conditions." Based on BNFL's definition of SDS SSCs, they are not required to operate in accident conditions.

### Required Action

BNFL must eliminate this phrase from the Safety Criterion text before the start of preliminary design.

### *Safety Criterion 4.4-21*

### Evaluation

This Safety Criterion was modified from applying to Design Safety Class I and II SSCs to Safety Design Class SSCs. However, it is not clear, whether this Safety Criterion applies only to accident conditions or both accident and normal operation conditions. If the latter, this Safety Criterion should be modified to apply to important to safety SSCs.

### Required Action

Prior to commencing preliminary design, BNFL must clarify the applicability of this Safety Criterion.

#### **e. Radiation Protection (Chapter 5)**

BNFL made significant revisions to the safety criteria in Chapter 5 in response to SRD questions 1, 2, and 152. BNFL also referenced sections of the ISMP as subordinate standards for each Safety Criterion in Chapter 5 in response to SRD question 157. These revisions required that the reviewers reevaluate the safety criteria against the requirements of 10 CFR 835 and the Top-Level Principles in DOE/RL-96-0006. This evaluation resulted in a finding that the safety criteria will need further revision to address the deficiencies identified below.

#### *Safety Criterion 5.0-1*

### Evaluation

This Safety Criterion commits to developing and submitting a Radiation Protection Program (RPP) for approval by the RU. It also requires that the content of the RPP address all items in 10 CFR 835 and the additional safety criteria provided in SRD, Volume II, Sections 5.1, and 5.2. ISMP Section 2.3.1, "Implementation of 10 CFR 835," and Section 2.3.3, "Radiation Protection Program," are cited as subordinate standards. Safety Criterion 5.0-1 is acceptable as it conforms to the regulatory requirements of 10 CFR 835 and Top-Level Principles 4.2.3.1, 4.3.2.1, and 4.3.2.2 of DOE/RL-96-0006. However, the referenced sections of the ISMP are not sufficiently detailed, only address radiation protection in general terms, and offer little information as to how the Safety Criterion will be met.

**The seven Safety Criteria in 5.1, *Occupational Radiation Protection***, conform to the regulatory requirements of 10 CFR 835 and Top-Level Principles 4.2.3.1, 4.3.2.1, and 4.3.2.2 of DOE/RL-96-0006. The following ISMP sections are cited as subordinate standards:

- 2.3.1, "Implementation of 10 CFR 835"
- 3.9.1.2, "Radiation Shielding and Access Control Features"
- 8.0, "Document Control and Maintenance"

The referenced sections of the ISMP are not sufficiently detailed, only address radiation protection in general terms, and offer little information as to how the safety criteria will be met. ISMP Section 8.0 has significant radiation protection deficiencies in that Table 8-1 does not identify ALARA records as records in the "Design" subject and all the records required by 10 CFR 835 are not identified in the Radiation Safety subject.

**The four Safety Criteria in 5.2, *Occupational Radiation Protection Design***, conform to the regulatory requirements of 10 CFR 835 and Top-Level Principles 4.2.3.1, 4.2.3.2, 4.3.2.1, and 4.3.2.2 of DOE/RL-96-0006. The following are cited as subordinate standards:

- ANS 6.4-85, "Guidelines on Nuclear Analysis and Design of Concrete Radiation

- Shielding for Nuclear Power Plants”
- ANS 6.4.2-85, “Specification for Radiation Shielding Materials”
- NRC Regulatory Guide 8.8, “Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Reasonably Achievable”
- ISMP Section 3.7, “Proven Engineering Practices”
- ISMP Section 3.9.2, “ALARA Design”

The ANS standards and the NRC Regulatory Guide provide sufficient detail that, when properly implemented, there is reasonable assurance that Safety Criteria 5.2-1 and 5.2-2 will be met. However, the referenced sections of the ISMP are not sufficiently detailed, only address radiation protection in general terms, and offer little information as to how Safety Criteria 5.2-3 and 5.2-4 will be met.

**Safety Criteria 5.3-3 and 5.3-4** do not conform to the Top-Level Principle 3.2, “Radiation Protection Objective,” in DOE/RL-96-0006 for the following reasons:

- The safety criteria do not address maintaining radiation exposures and environmental impacts within prescribed limits, and
- The safety criteria do not address mitigation of radiation exposure and environmental impact due to accidents.

**Safety Criteria 5.3-5 and 5.2-2** do not conform to the Top-Level Principle 4.2.3.2, “Radiation Protection Features”, because there is no commitment to maintain radiation exposures or keep emissions of radioactive effluents within prescribed limits.

**The seven Safety Criteria in 5.3, *Environmental Radiation Protection***, cite ISMP sections 2.4, “Compliance with Contractual Obligation for ERPP,” and 3.9.2, “ALARA Design,” as subordinate standards. These referenced sections of the ISMP are not sufficiently detailed, only address radiation protection in general terms, and offer little information as to how the safety criteria will be met. Appendix B to WAC 246-247, “Radiation Protection – Air Emissions,” provides sufficient detail such that there is reasonable assurance that the air portion of Safety Criterion 5.3-3 will be met; however, there is insufficient detail as to how the liquid effluent portion will be met.

**The nine Safety Criteria in 5.4, *Environmental Radiological Monitoring***, comply with the regulatory requirements of 40 CFR 61, WAC 246-221, and WAC 246-247. ISMP sections 2.4, “Compliance with Contractual Obligation for ERPP,” and 3.9.1.3, “Radiation Monitoring,” are cited as subordinate standards. However, the referenced ISMP sections are not sufficiently detailed, only address radiation protection in general terms, and offer little information as to how Safety Criterion in 5.4 will be met.

In summary, the revised safety criteria presented by BNFL in Chapter 5 of the SRD Volume II, Revision 1, are unacceptable.

### Required Action

BNFL must revise the safety criteria in Chapter 5 of the SRD to conform to the entire Top-Level Principle of DOE/RL-96-0006, Section 3.2, “Radiation Protection Objectives”:

- The safety criteria must address maintaining radiation exposures and environmental impacts within prescribed limits, and
- The safety criteria must address mitigation of radiation exposure and environmental impact due to accidents.

BNFL must also revise the safety criteria to conform to the Top-Level Principle of DOE/RL-96-0006, Section 4.2.3.2, “Radiation Protection Features”:

- The safety criteria must address a commitment to maintain radiation exposures or keep emissions of radioactive effluents within prescribed limits.

The subordinate standards must also be revised to provide sufficient detail such that there is reasonable assurance that the safety criteria will be met. These revisions must be completed before the start of preliminary design.

#### **f. Startup (Chapter 6)**

Please see the discussion for Approval Condition 9, which covers this chapter.

#### **g. Management and Operations (Chapter 7)**

### Evaluation

BNFL’s revisions to Chapter 7 incorporated subordinate standards, as noted in response to SAP Question 157 and BNFL Inc. Letter 5193-98-0023, into the SRD. Safety Criterion 7.2-3 was deleted in accordance with BNFL’s response to RL/REG-98-01 review Question 1 regarding removal of safety criteria that were potentially contradictory to 10 CFR 835. Safety Criterion 7.4-2 was revised in accordance with BNFL’s response to RL/REG-98-01 review Question 90 committing BNFL not to undertake, without RU approval, any activity where the initiation of the activity would itself involve an unreviewed safety question. The reviewers found these changes are adequate.

As discussed under Condition 16, “Process Safety Management Program,” Safety Criterion 7.7-9 was revised, per a BNFL Project Safety Committee (PSC) comment, to delete reference to draft 10 CFR 830.350. The specific PSC comment and rationale were not submitted. The change to Safety Criterion 7.7-9 is therefore unacceptable.

### Required Action

BNFL must provide the rationale for the deletion of the reference to draft 10 CFR 830.350 before submitting the request for authorization of production operations.

**h. Deactivation and Decommissioning (Chapter 8)**Evaluation

The reviewers examined SRD, Rev. 1, Chapter 8, “Deactivation and Decommissioning (D & D)” for consistency with the disposition of SRD related RU questions and for consistency with Authorization Basis documents in general. In responding to RL/REG-98-01 Question 157, BNFL committed to provide subordinate standards or *ad hoc* standards to supplement Top-Level Principles. Chapter 8 in the Revision 0 version of the SRD did not include subordinate standards. In implementing the RL/REG-98-01 review Question 157 commitment to Chapter 8, BNFL referenced the ISMP as the source of subordinate standards for D & D. The ISMP was revised to include *ad hoc* standards for D & D. The ISMP *ad hoc* standards for D & D include criteria to be used in developing a deactivation plan.

**i. Documentation and Submittals (Chapter 9)**

Safety Criteria 9.0-1, 9.0-2, 9.0-3, 9.1-3, 9.1-4, 9.2-1, 9.2-2, 9.2-3, 9.2-4, 9.3-1, 9.3-2, 9.3-3, 9.3-4, and 9.3-5 do not identify adequate subordinate standards for the associated Top-Level Principles or rules, as applicable. The details of these deficiencies are described below.

*Safety Criterion 9.0-1*Evaluation

This Safety Criterion cites ISMP Section 9.2, “Scheduling of Events for Regulatory Submittals” as the subordinate standard. The ISMP section is similar to but less specific than the Safety Criterion. For example, ISMP Section 9.2 does not specify that the annual report must be submitted to local officials.

Required Action

The subordinate standard must be revised to be at least as specific as the overlying Safety Criterion. This discrepancy must be corrected before submission of the first annual report.

*Safety Criterion 9.0-2*Evaluation

This Safety Criterion does not reference an adequate subordinate standard for the internal safety assessment to be completed before submitting a request for construction authorization. An appropriate subordinate standard should address the level, rigor, and manner in which this safety assessment would be performed. ISMP Sections 3.16 and Chapter 10 could provide appropriate levels of detail for this purpose, if a specific cross-reference to the requirement of Safety Criterion 9.0-2 is added to one of these ISMP sections.

Required Action

BNFL must identify an adequate subordinate standard for the internal safety assessment before

submission of the pre-construction authorization SRD revision.

*Safety Criterion 9.0-3*

Evaluation

This Safety Criterion does not reference an adequate subordinate standard for the pre-startup safety review. An appropriate subordinate standard should address the level, rigor, and manner in which this pre-startup safety review would be performed. ISMP Sections 3.16 and Chapter 10 could provide appropriate levels of detail for this purpose, if a specific cross-reference to the requirements of Safety Criterion 9.0-3 is added to one of these ISMP sections.

Required Action

BNFL must identify an adequate subordinate standard for the pre-startup safety before submission of the FSAR.

*Safety Criterion 9.1-3*

Evaluation

This Safety Criterion does not reference an adequate subordinate standard for a process to resolve safety issues before PSAR submittal. An adequate subordinate standard should address how these safety issues will be corrected before PSAR submittal. ISMP Sections 3.16 and Chapter 10 could provide appropriate levels of detail for this purpose, if a specific cross-reference to the requirements of Safety Criterion 9.0-2 is added to one of these ISMP sections.

Required Action

Resolution of this discrepancy should be coordinated with the resolution of the Safety Criterion 9.0-2 discrepancy discussed above, and must be corrected before submission of the pre-construction authorization SRD revision.

*Safety Criterion 9.1-4*

Evaluation

This Safety Criterion does not reference an adequate subordinate standard for the FSAR annual review and update. An adequate subordinate standard should address all aspects of proposed FSAR changes including configuration management, QA, and the review process. These aspects are discussed as processes in ISMP Sections 3.3.2, 3.3.3, 3.16, 1.3.16, and Section 10, but are not cited as a subordinate standard. Rather, ISMP Section 3.3.3.2 is cited, but does not provide an adequate subordinate standard.

Required Action

An adequate subordinate standard for FSAR annual review and update must be corrected before

submission of the FSAR.

*Safety Criteria 9.2-1, 9.2-2, 9.2-3, and 9.2-4*

#### Evaluation

These safety criteria do not reference adequate subordinate standards related to Technical Safety Requirements (TSRs). The SRD references ISMP Section 3.3.1.4 as the subordinate standard which then refers the reader back to Safety Criterion 9.2-3 (a circular, and incomplete justification). Possible appropriate subordinate standards could be DOE Order 5480.22, or ISMP section 4.2.3.

#### Required Action

An adequate subordinate standard related to Technical Safety Requirements must be corrected before submission of the FSAR.

*Safety Criterion 9.2-6*

#### Evaluation

This Safety Criterion does not reference an adequate subordinate standard for operation of the facility in accordance with the TSRs. Portions of ISMP Section 1.3.15 could provide an adequate subordinate standard, if cited. This ISMP Section was appropriately used in other safety criteria for this purpose and could meet the intent for this Safety Criterion.

#### Required Action

An adequate subordinate standard for operation of the facility in accordance with the TSR's must be corrected before submission of the FSAR.

*Safety Criteria 9.3-1, 9.3-2, 9.3-3, 9.3-4, and 9.3-5*

#### Evaluation

These safety criteria do not address risk management plans, off-site consequence analysis, periodic plan reviews, document controls, and updates, all of which are requirements of the EPA Risk Management Programs rule 40 CFR 68. The subordinate standard is therefore incomplete.

#### Required Action

Requirements of the EPA Risk Management Program rule 40 CFR 68 must be addressed prior to submittal of the FSAR.

*Safety Criteria 9.1-6 and 9.1-7*



### Evaluation

Changes were made to these safety criteria without explanation. Specific examples are detailed below.

The words “to DOE” were inserted into the second paragraph of ISMP Section 3.2, “Safety Responsibilities.” This ISMP Section is the subordinate standard cited by Safety Criterion 9.1-6. The change is unnecessary, and may imply that the purpose of executing the safety responsibilities is to provide assurance to DOE. This implication would not be acceptable as the principal purpose of this Safety Criterion.

Safety Criterion 9.1-7 wording was significantly modified from the hazard analysis “shall be submitted for approval as part of the SAR” to “shall be submitted for review.” This change is inappropriate, and may be misleading. The RU requires that successive refinements of the hazard analysis be submitted as part of the construction and operating authorizations. Construction and operating authorization will not be given if the hazard analyses are inadequate. The RU is required to determine when the hazards have been adequately assessed. This determination is an approval.

### Required Action

BNFL must delete the addition of the words “to DOE” in ISMP Section 3.2, and revise Safety Criteria 9.1-7 to its original wording.

## **APPENDIX A, EVALUATION OF BNFL SAFETY REQUIREMENTS DOCUMENT, REVISION 1A**

This section of Appendix A documents the RU evaluation of the BNFL response to recurring problems, which were initially documented in Section 2 of RL/REG-98-20, Revision 0.

### **1. EVALUATION OF BNFL RESPONSE TO RECURRING PROBLEMS**

#### **a. Recurring Problem 1 - Subordinate Safety Standards**

##### Action Required

*BNFL must, prior to proceeding with preliminary design, correct the deficiencies associated with subordinate standards required for preliminary design.*

##### Summary of BNFL Response

As noted throughout Appendix A, BNFL modified subordinate standards to address this recurring problem. Additionally, BNFL reviewed the two recent position papers (“Regulatory Unit Position on Tailoring for Safety – RL/REG-98-17,” July 31, 1998, and “Regulatory Unit Position on Selected Hazard Control Strategy Issues – RL/REG-98-02,” August 14, 1998) where the RU amplified requirements for developing subordinate standards. BNFL Inc. has incorporated the intent of these position papers in its Implementing Standard for Safety Standards and Requirements Identification. This *ad hoc* standard emphasizes systematic identification of a control for mitigation or prevention of each hazard.

##### Evaluation

The RU evaluated changes in both the subordinate standards and in BNFL’s approach, as documented by their Implementing Standard for Safety Standards and Requirements Identification. In addition, the RU examined the BNFL commitment associated with the scope and content of the Design Safety Features deliverable as defined in Standard 4, Section c.2)(g) of the contract.

In general, BNFL’s selection of subordinate standards in SRD Revision 1A is acceptable. As design progresses, additional tailoring of the subordinate standards in the SRD to the hazards associated with the TWRS-P Project is expected. For example, BNFL cites IEEE 338 as a subordinate standard for Safety Criterion 4.4-4. This IEEE standard (Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems) is generally related to requirements for nuclear power stations that may, or may not be required in their totality for TWRS-P. SRD Revision 1A cites the entire IEEE standard.

The reviewers concluded that the Implementing Standard for Safety Standards and Requirements Identification provided adequate assurance that BNFL’s methodology for developing subordinate standards was technically sound.

The BNFL response was acceptable.

**b. Recurring Problem 2 – Configuration (Document Change) Control**

Action Required

*BNFL must implement an effective configuration management system to attain timely approval of authorization basis regulatory submittals. Two of the many features the configuration management system should include are precise identification of changes and clear justification of the need for the change.*

Summary of BNFL Response

BNFL provided further identification and justifications of changes to the SRD (and ISMP) which were not disclosed or adequately justified. In response to this review, ISMP Revision 3A was revised on Pages 11-8, 11-9, 11-11, and 11-12 and SRD Revision 1A, Volume I was revised on Pages 1-1, 2-1, 3-3, and 4-2.

BNFL Inc. has developed detailed procedures addressing changes to the SRD and ISMP. These procedures specify the configuration control requirements for changes including providing clear identification of changes (e.g., redline/strikeout) and clear justification of the need for the change.

Evaluation

The RU evaluated the BNFL review of undocumented changes. In addition, on November 13, 1998, the RU met with the cognizant BNFL staff to review current and draft procedures, with an emphasis on the adequacy of the BNFL document control program. The review found that these procedures, when fully implemented, would result in an adequate document control program. At this meeting, BNFL committed to have the draft procedures finalized and implemented by November 25, 1998.

The BNFL response was acceptable.

**2. EVALUATION OF CHANGES ASSOCIATED WITH CONDITIONS OF APPROVAL**

This section of Appendix A documents the RU evaluation of changes associated with conditions of approval, which were initially documented Section 3 of RL/REG-98-20, Revision 0. The following describes the action required for acceptance, the BNFL response, and the RU evaluation for only those remaining conditions that were addressed by the BNFL SRD Revision 1A submittal.

## **Condition 2 – Defense in Depth**

### Action Required

*BNFL must revise the SRD and the ISMP to provide adequate subordinate standards for the six principles of defense in depth. The subordinate standards should be established based on the process of DOE/RL-96-0004. These standards should have sufficient detail so that the end user can consistently determine the required features and the appropriate number of layers of defense in depth required for a specific hazard.*

### Summary of BNFL Response

BNFL developed and transmitted to the Regulatory Unit (BNFL Letter #W375-98-000521) a new implementing standard for Defense in Depth (BNFL-5193-SRD-01, Revision 1A, Appendix B). This implementing standard provides standards for implementing the six sub-principles of defense in depth.

BNFL revised the SRD to link the Safety Criteria related to the six Defense in Depth sub-principles to the new implementing standard, rather than to various, scattered sections of the ISMP, as was done previously. In addition, two other Safety Criteria – SC 1.0-6 and SC 4.3-5 – were revised to reference the new Defense in Depth Implementing Standard.

### Evaluation

Extensive discussion and several open meetings between BNFL and the RU were conducted to discuss the proposed standard. The Defense in Depth Implementing Standard, when considered with the supporting Implementing Standard for Safety Standards and Requirements, defined a hierarchy of layers of controls to be applied based on the severity of the hazard that would result from failure of the selected SSC. The standard also defined when and to what degree SSCs would be required to be redundant. Finally, standard terminology and consensus subordinate standards were defined. Tailoring of the consensus standards to this facility's hazards was not completed. The subordinate standards used some undefined generic power reactor terms. BNFL committed to complete the tailoring by December 2, 1998, before detailed application of the consensus standards.

Therefore, pending completion of the additional tailoring of the referenced industry standards and RU acceptance of this tailoring, interim use of the implementing standards submitted by BNFL is conditionally approved until December 16, 1998, or RU approval of the revised standards, whichever is sooner.

## **Condition 3 – Safety Responsibility**

### Action Required

- 1) BNFL must revise Safety Criterion 1.0-9 to address ultimate safety on a broader scope than just "safe operation of the TWRS-P Facility." A standard equivalent to*

*Section 3.2 of the ISMP would serve as an appropriate alternative. This Part A condition shall be corrected before the start of preliminary design.*

- 2) *BNFL must revise the implementing standard for Safety Criterion 7.0-2 (ISMP Section 3.1) to include implementing standards on “automatic systems” and “control” of important to safety SSCs.*

#### Summary of BNFL Response

- 1) SC 1.0-9 was revised to read: “BNFL Inc. shall accept ultimate responsibility for the safety of TWRS-P.” The last sentence of the first paragraph of ISMP Section 1.0 was also revised to read: “BNFL Inc. accepts ultimate responsibility for the safety of the TWRS-P Facility.”
- 2) The Implementing Standard for Defense in Depth has been added as an implementing standard for Safety Criterion 4.3-4 for the design phase. The implementing standards on “control” of important to safety SSCs during operation will be the subject of an operating standard to be identified prior to the Operating Authorization Request (OAR), as noted in the comment for Safety Criterion 7.0-2.

#### Evaluation

The RU examined the text and standard changes made by BNFL. The revision of SC 1.0-9 adequately assigns ultimate safety responsibility to BNFL.

This implementing standard applies to Top-Level Principle 4.1.1, “Defense in Depth.” Top-Level Principles 4.1.1.3 and 4.1.1.5, “Control” and “Automatic Systems,” respectively, are sub-principles of Top-Level Principle 4.1.1. Therefore, modification of SC 4.3-4 to reference the Defense in Depth implementing standard adequately addresses the action required, since SC 4.3-4 applies primarily to the design phase and SC 7.0-2 applies to operating phase. The RU recognizes the BNFL commitment to add standards for operations at a future date.

Therefore, the BNFL responses to this condition of approval were acceptable.

#### **Condition 4 – Authorization Basis**

##### Action Required

*Before the start of preliminary design, BNFL shall revise the SRD to establish standards that conform to Top-Level Principle 4.1.3.1. (The RU has issued RL/REG-97-13, Revision 3, which describes an acceptable approach with regard to the information included within the Authorization Basis and the process associated with ensuring that the integrity of the Authorization Basis is maintained. Conformance to RL/REG-97-13, Revision 3 is required by Standard 4 of the new contract.)*

### Summary of BNFL Response

A new Safety Criterion was added to SRD Volume II Section 9.0 “Documentation and Submittals” to satisfy Top-Level Principle 4.1.3.1. The Safety Criterion states: “Material that is part of the authorization basis shall be established, documented, and submitted to the Director of the Regulatory Unit for evaluation and in support of decisions and regulatory oversight. The material shall be maintained current with respect to changes made to the facility design and administrative controls in the light of significantly new information.”

### Evaluation

The RU reviewed the new safety criterion against contract requirements and determined that the proposed criterion, along with approved modifications to ISMP Revision 3A Section 3.3.3, “Changes to the Authorization Basis,” adequately conform to Top-Level Principle 4.1.3.1.

Therefore, the BNFL response to Approval Condition 4 was acceptable.

## **Condition 5 – Proven Engineering Practices**

### Action Required

- 1) *Prior to the start of preliminary design, BNFL must revise Safety Criterion 4.3-3 to conform to the Common-Mode/Common-Cause requirements of Top-Level Principle 4.2.2.2.*
- 2) *Prior to the start of preliminary design, BNFL must revise Safety Criteria 4.1-2, 4.4-2, and 4.4-3 to eliminate qualifying statements to and contradictions with Top-Level Principle 4.2.2.3.*

### Summary of BNFL Response

- 1) SC 4.3-3 was revised to be consistent with TLP 4.2.2.2.
- 2) Safety Criteria 4.4-2 was revised to eliminate the qualifying statements and ensure consistency with Top-Level Principle 4.2.2.3. With this change, Safety Criteria 4.4-3 is not required and was deleted from the SRD. With these revisions, no change was required for Safety Criterion 4.1-2.

### Evaluation

The RU reviewed the change and concluded that BNFL incorporated the necessary language in SC 4.3-3 and SC 4.4-2SC 4 by adding the sentence: “Design provisions should be included to limit the loss of safety functions due to damage to several structures, systems, or components important to safety resulting from a common-cause or common-mode failure.” This language duplicates that of Top-Level Principle 4.2.2.2, “Common-Mode/Common-Cause Failure.”

SC 4.4-2 was revised to read, “Structures, systems, and components important to safety shall be designed and qualified to function as intended in the environments associated with the events for which they are intended to respond. The effects of aging on normal and abnormal functioning shall be considered in design and qualification.” This language duplicates that of Top-Level Principle 4.2.2.3, “Safety System Design and Qualification.”

The BNFL responses were acceptable.

## **Condition 8 – Reliability, Availability, Maintainability, and Inspectability**

### Action Required

- 1) *Prior to starting preliminary design, Safety Criterion 4.4-4 must be modified so that it requires SSCs to be designated, designed, and constructed for appropriate inspection, testing, and maintenance.*
- 2) *Prior to starting preliminary design, ISMP Section 3.13, which is the subordinate standard for Safety Criterion 4.4-4, must be modified to assign reliability targets to all SSCs important to safety.*
- 4) *Prior to preliminary design, BNFL must identify and cite appropriate implementing codes or standards for Safety Criterion 7.6-3 that implements Top-Level Principle 4.2.7.1.*

### Summary of BNFL Response

- 1) SC 4.4-4 was revised to require SSCs to be designated, designed and constructed for appropriate inspection, testing and maintenance. In addition, the new Implementing Standard for Safety Standards and Requirement Identification (BNFL-5193-SRD-01, Revision 1A, Appendix A) was added as an Implementing Code and Standard.
- 2) ISMP Section 3.13, “Reliability, Availability, Maintainability, and Inspectability (RAMI)” was revised to address the assignment of reliability targets to all SSCs important to safety.
- 3) The revised ISMP Section 3.13 and the Implementing Standard for Safety Standards and Requirements Identification (BNFL-5193-SRD-01, Rev 1a, Appendix A) were included as Implementing Standards for SC 7.6-3.

### Evaluation

The revisions to SC 4.4-4 referencing the RU approved Implementing Standard for Safety Standards and Requirements were evaluated and are acceptable. Safety Criterion 4.4-4 now includes “structures,” along with “systems and components that will be designated, designed and constructed to permit appropriate inspection, testing, and maintenance...” The proposed text revisions to ISMP Section 3.13 were evaluated and are acceptable because a paragraph was added that refers to the newly approved Implementing Standard on Safety Standards and Requirements Identification . The same

implementing standard was referenced in SC 7.6-3, along with the modified ISMP Section 3.1.3.

The BNFL responses were acceptable.

### **Condition 15 – General Process Safety Overall Principles**

#### Action Required

*Prior to beginning preliminary design, BNFL shall revise safety criteria to establish standards that conform to Top-Level Principle 5.1.3, “Process Safety Responsibility.”*

#### Summary of BNFL Response

BNFL revised SC 1.0-9 to read, “BNFL Inc. shall accept ultimate responsibility for the safety of the TWRS-P Facility.” This commitment to ultimate responsibility for safety envelops the responsibility for process safety required by Top-Level Principle 5.1.3.

#### Evaluation

The BNFL response unambiguously assigns responsibility for safety to BNFL.

The BNFL response was acceptable.

### **Condition 16 – Process Safety Management Program**

#### Action Required

1. *Prior to beginning preliminary design, BNFL must provide justification for modifying Safety Criterion 7.7-9 to delete the requirement that subcontractors and suppliers comply with 10 CFR 830.350 (b) and (e).*
2. *Prior to the start of preliminary design, BNFL must revise Table “DOE/RL-96-0006 Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors” (Sheet 8) on page E-17. Safety Criteria 3.1-2 and 3.1-4 must be added to achieve conformance with Top-Level Principle 5.2.2, “Process Hazard Analysis” and Safety Criterion 7.4-1 to achieve conformance with the Top-Level Principle 5.2.10.*

#### Summary of BNFL Response

1. In accordance with contract changes, reference to Draft DOE Nuclear Safety regulations (e.g., 10 CFR 830.350) were removed. These changes are contained in the current TWRS Privatization Contract No. DE-RP06-96RL13308, Table S4 1, “Radiological, Nuclear and Process Safety Deliverables for Part A and Part B.” For Occurrence Reporting, Table S4-1 references DOE/RL-96-0006, 29 CFR 1910, and 40 CFR 68. With respect to reporting of defective conditions



by subcontractors, no specific regulatory basis was identified; as such, BNFL will specify the reporting requirements in applicable procurement documents as specified in SC 7.7-9.

2. The Top-Level Principles were added to the Regulatory Basis for these Safety Criteria.

### Evaluation

The RU accepts the BNFL position to remove references to draft DOE Nuclear Safety regulations (e.g., 10CFR 830.350) from SC 7.7-9. The RU confirmed that references to SC 3.1-2, SC 3.1-4, and SC 7.4-1 were added to page E-17 of SRD Revision 1A, Volume I.

The BNFL responses were acceptable.

## **3.0 EVALUATION OF CHANGES IN RESPONSE TO REVIEWER QUESTIONS**

This section of Appendix A documents the RU evaluation of changes that BNFL made in response to reviewers questions during the review of BNFL SRD Revision 0. Many of the RU issues were resolved by the changes proposed in SRD Revision 1. In a few cases, the reviewers identified new issues, primarily related to the adequacy of subordinate standards. The following describes the action required for acceptance, the BNFL response and the RU evaluation.

### **Volume 1 – Demonstrate ISM Process**

#### Action Required

*Before the start of preliminary design, BNFL must demonstrate how the ISM process was used to select subordinate standards.*

#### Summary of BNFL Response

Under the BNFL Inc. process, the Hazard Analysis associated with the early stage of the design does not demand specific design choices to be made and confirmed. To capture the important points associated with the controls for hazards, the set of controls action items are documented in the Hazard Schedule. As the design progresses, the action items in the Hazard Schedule must be undertaken and resolved by a multi-disciplinary team.

The integrity of the process from work (system design) through SSC's for prevention and mitigation was assured through the way the same key individuals, augmented by other experts as necessary, performed the analysis. In two recent position papers, the RU amplified expectations regarding the application of the ISM process. BNFL Inc. has incorporated the essence of these position papers in its Implementing Standard for Safety Standards and Requirements Identification. This *ad hoc* standard emphasizes identification of a control for mitigation or prevention of each hazard.

### Evaluation

The RU evaluated changes in both the subordinate standards and in BNFL's approach, as documented by their Implementing Standard for Safety Standards and Requirements Identification. In addition, the RU examined the BNFL commitment associated with the scope and content of the Design Safety Features deliverable as defined in Standard 4, Section c.2)(g) of the contract.

The BNFL response was acceptable.

### **Volume 2 – Section 4.2.a – Radiological, Nuclear and Process Safety Objectives**

#### Action Required

1. *Prior to the start of preliminary design, BNFL must tailor these identified sections of the ISMP to the safety criteria. The ad hoc standards lack specificity to achieve conformance.*
2. *BNFL must clarify which definitions it intends to apply to Safety Criterion 1.0-3.*
3. *BNFL must provide the rationale for striking out this sentence, considering that Top-Level-Principle 4.1.1.1 states "...safety is vested in multiple, independent safety provisions, no one of which is to be relied upon excessively to protect the public, the workers and the environment." This issue must be corrected before the start of preliminary design.*
4. *Prior to the start of preliminary design, BNFL must revise Safety Criterion 1.0-8 to be consistent with the contract definition provided in DOE/RL 96-0006 and the ISMP.*

#### Summary of BNFL Response

1. The new Implementing Standard for Defense in Depth (BNFL-5193-SRD-01, Rev 1A, Appendix B) and its corresponding Code of Practice (K70C520) are in full conformance with Top-Level Principle 4.1.1.1 and are cited as Implementing Codes and Standards for SC 1.0-2, 1.0-6, and 1.0-7 in response to RL/REG-98-20 Condition 2. These documents commit that hazard control strategies will employ the single failure criterion commensurate with the hazard severity. Both documents contain a table that provides guidance on the adequacy of the number of active SSCs (i.e., barriers) to be considered in achieving the desired reliability and on application of the single failure criterion for hazards of varying severity.
2. The reference to ISMP Section 12.0 will be clarified by adding specific reference to the definition of "Controlled Area." In addition, Radiological Exposure Standards for the TWRS-P Project, RESW (SRD Volume 1 Appendix F) will be added as an implementing standard demonstrating conformance with the Accident

#### Risk Goal.

3. The previously deleted sentence has been reinserted into the ISMP; reworded slightly to avoid the implication that defense in depth is achieved solely by application of the single failure criterion.
4. The first two paragraphs of the Safety Criteria have been revised to be consistent with the definition of Important to Safety from DOE/RL-96-0006.

#### Evaluation

The RU evaluated the changes proposed by BNFL in response to the first item as part of the review of Defense in Depth. The changes are acceptable because the RU approved the BNFL Implementing Standard on Defense in Depth. The second item was evaluated by the RU team reviewing the BNFL radiation protection program and is acceptable. The changes committed to in the third and fourth items were verified and are acceptable.

The BNFL responses were acceptable.

### **Volume 2 – Section 4.2.d – Engineering and Design**

#### Action Required

1. *The commitment to cite BNFL’s “Accident Analysis Procedure” must be met before initiation of preliminary design and further hazard analysis to assure that the standard is applied as intended.*
2. *BNFL must revise this Safety Criterion [4.3-2 and 4.3-5] to also apply to Safety Design Significant SSCs, i.e., to all important to safety SSCs. This revision must be completed before the start of preliminary design.*
3. *BNFL shall identify additional codes or standards that address implementation of the remaining elements of the Top-Level Principles 4.2.4.1 and 4.2.6.2 before the start of preliminary design.*
4. *BNFL must eliminate the phrase “...and accident conditions” from the Safety Criterion [4.4-7 and 4.4-20] text before the start of preliminary design.*
5. *Prior to commencing preliminary design, BNFL must clarify the applicability of this Safety Criterion [4.4-21].*

#### Summary of BNFL Response

1. Safety Criterion 4.2-1 and 4.3-4 have been revised to include the Defense in Depth Implementing Standard.

For Safety Criteria 3.2-1, 4.2-2, and 4.2-3, ESH-03-TWRS is being replaced with a new Implementing Standard which fully complies with the DOE/RL-96-0004 Process, *Implementing Standard for Safety Standards and Requirements Identification*. This Standard will replace ESH-03-TWRS in its entirety. This Standard will also replace K0104\_REP\_SAF *Process Hazard Analysis Procedure for TWRS-P* as an Implementing Standard for Safety Criteria 3.1-6

For Safety Criterion 4.3-7, ESH-03-TWRS is replaced by citing NUREG-0800, Standard Review Plan, Revision 2, Section 6.4 “Control Room Habitability System,” Section II Acceptance Criteria items # 1 through 5 as an implementing standard. This standard which is used to implement 10 CFR 50 Appendix A, General Design Criteria 19 for protection of control room operators against radiation and toxic chemical hazards will be tailored to remove reactor specific criteria.

2. Safety Criteria 4.3-2 and 4.3-5 were revised to apply the principles of these safety criteria to all Important to Safety (ITS) Systems, Structures and Components (SSCs) when single failure protection is required. The Implementing Standard for Defense in Depth (BNFL-5193-SRD-01, Revision 1A, Appendix A) provides criteria for when single failure protection is required. This implementing standard has been added to both SC 4.3-2 and 4.3-5 as implementing codes and standards.
3. Top Level Principle 4.2.6.2 is also addressed by SC 4.3-4 (Volume I Appendix E), which addresses the need for instrumentation and control capability. Top-Level Principle 4.2.4.1, as noted in RL/REG-98-01, is adequately addressed by SC 4.3-7.
4. The phrase “and accident” was deleted from Safety Criteria SC 4.4-7 and 4.4-20 this phrase was also deleted from two other Safety Criteria addressing Safety Design Significant SSCs (SC 4.4-12 and 4.4-16).
5. SC 4.4-21 was revised to clarify the applicability of this criterion to motor operated valves.

### Evaluation

Reviewers evaluated the changes proposed by BNFL in response to the first item and found that they are acceptable because the RU has approved the two referenced BNFL implementing standards and because the reference to Section II of NUREG 0800 in order to protect Control Room operators is acceptable. Regarding the second item, the RU determined that the revisions were acceptable in the context of the safety criteria applications, i.e., single failure protection of important to safety systems where defense in depth does not apply. The BNFL response to the third issue, together with their description in meetings of how the need to require additional locations for distributed control areas will be evaluated as the design matures, is acceptable. The RU verified that BNFL made the text changes required by the fourth issue and had acceptably clarified the applicability of this safety criterion for motor operated valves.

The BNFL responses were acceptable.

## **Volume 2 – Section 4.2.e – Radiation Protection (Chapter 5)**

### Action Required

*BNFL must revise the safety criteria in Chapter 5 of the SRD to conform to the entire Top-Level Principle of DOE/RL-96-0006, Section 3.2, “Radiation Protection Objectives”:*

- *The safety criteria must address maintaining radiation exposures and environmental impacts within prescribed limits, and*
- *The safety criteria must address mitigation of radiation exposure and environmental impact due to accidents.*

*BNFL must also revise the safety criteria to conform to the Top-Level Principle of DOE/RL-96-006, Section 4.2.3.2, “Radiation Protection Features”:*

- *The safety criteria must address a commitment to maintain radiation exposures or keep emissions of radioactive effluents within prescribed limits.*

*The subordinate standards must also be revised to provide sufficient detail such that there is reasonable assurance that the safety criteria will be met. These revisions must be completed before the start of preliminary design.*

### Summary of BNFL Response

BNFL proposed changes to resolve SRD Chapter 5 review comments in four separate correspondences. The RU reviewer’s comments involved the following two issues:

- 1) Safety Criteria 5.3-3, 5.3-4, 5.3-5 and 5.2-2 do not conform to Top-Level Standards in DOE/RL-960006, and
- 2) ISMP sections identified as implementing standards for Safety Criteria in Chapter 5 were not acceptable as implementing standards.

BNFL’s initial changes were received on November 6, 1998 (Letter 000557) and included expanded descriptions to the ISMP and changes to the SRD Safety Criteria 5.3-3, 5.3-4, 5.3-5 and 5.2-2. The reviewers concluded that the expanded ISMP sections were not adequate as implementing standards.

On November 16, 1998 (Letter 000557), and again on November 25, 1998 (Letter 000780), BNFL submitted further correspondence to address the implementing standards issue with respect to SRD Chapter 5. In the proposed resolution, Safety Criterion 5.3-3 was deleted, as it was duplicated in Safety Criterion 5.3-1, and changes were made to 5.3-4, 5.3-5 and 5.2-2 to achieve conformance with DOE/RL-96-0006 Top-Level Principles

3.2 and 4.2.3.2. BNFL incorporated Safety Criterion 5.3-2 into Safety Criterion 5.3-1 and the Safety Criteria in Section 5.2 were deleted, as they were duplicated in Safety Criterion 5.0-1.

### Evaluation

The reviewers found that the changes to SRD Safety Criteria 5.3-4, 5.3-5 and 5.2-2 presented in the November 16, 1998 letter conformed to DOE/RL-96-0006 Top-Level Principles 3.2 and 4.2.3.2. The reviewers found that the unified Safety Criterion 5.3-1 was acceptable and that Safety Criterion 5.3-4 was duplicated in Element (5) of the revised Safety Criterion 5.3-1 and could be deleted. The reviewers also found that all the Safety Criteria in Section 5.2 were duplicated in Safety Criterion 5.0-1 and any deletions to the SRD could be made in accordance with BNFL's approved procedures for managing changes to the authorization basis.

The implementing standards identified for the Safety Criteria in Sections 5.0 and 5.1 were acceptable because they adequately covered the criteria topics and were widely accepted industry standards.

By letter dated December 1, 1998 (000789), BNFL identified DOE Implementation Guide G-10 CFR/B2 as an implementing standard for Element (5) of Safety Criterion 5.3-1. In their November 25, 1998 Letter (000780), BNFL submitted a set of implementing standards for Safety Criterion 5.3-1. These proposed implementing standards are substantial, requiring detailed RU review that will extend beyond December 2, 1998. As a result of late receipt of these implementing standards, the RU establishes the following condition on design start until these implementing standards are reviewed and accepted.

The condition is that BNFL may start preliminary design activities of structures, systems or components except for those associated with effluent and environmental monitoring (including sources of airborne emissions, sources of discharge in liquid waste streams and effluent monitoring), and ground water protection until the RU approves implementing standards for these activities. This conditional approval will be revoked after February 2, 1998, if the RU has not approved an acceptable set of implementing standards for SRD Safety Criteria 5.3 and 5.4.